NATIONAL PETROLEUM NEWS

January 2, 1946

TECHNOLOGY DEPT.

JAN 3 1946
DETROIT

# Texas Oil Man Wears Croix De Guerre and Bronze Star Medal

When Col. Marvin Charlton returns to Del Rio Tex., and his post as distributor for Standard Oil Co. of Texas, he will be wearing the French Croix de Guerre, with Palm, "for services rendered France during the liberation. . . ." in addition to the American Bronze Star Medal.

Former Southwest Texas district sales manager for Humble Oil & Refining Co., Col. Charlton was commanding officer of the 1585th Quartermaster Truck Group. He was recently assigned to duty in Washington with the joint Army-Navy Purchasing Agency, replacing Maj. John P. Knight.

Col. Charlton received the high French decoration from Gen. A. F. M. Doty (see photo at right), commanding general of the French garrison at Metz, in formal services held at Luxembourg City, in the presence of Grand Duchess Charlotte.

The colonel was among those who assisted in preparation and co-ordination of the petroleum plan for the invasion of the continent while on special assignment with Supreme Headquarters, AEF. Prior to the special assignment the colonel, who had been in ETO since September, 1942, had been civil affairs officer for Southern Base Section in the United Kingdom and provost marshall in metropolitan London. The 1585th Quartermaster Truck Group was a unit of the 9th Air Force Service Command which supplied and maintained the technical power of the force during the liberation of Europe.

In addition to the two personal decorations, his truck group received a citation and was awarded the Meritorious Service Unit Plaque. The colonel also wears five battle stars for the battles of Normandy, Northern France, Rhineland, Ardennes (Bulge) and Central Europe.

Gen. Doty Col. Charlton

The text of his Bronze Star Medal citation follows: "Marvin Charlton, colonel, Air Corps., while serving with the Army of the United States, distinguished himself by meritorious service in connection with military operations not involving participation in aerial flight against any enemy of the United States during the period May 1, 1944, to Feb. 28, 1945. Col. Charlton personally supervised the technical and tactical training of units of the 1585th Quartermaster Truck Group, Aviation, in preparing for highly important operations in connection with establishing initial airstrips on the continent. After his truck companies had accomplished their initial mission of delivering landing mats, carried across the channel for the construction of air strips, he kept his complete organization fluid and capable of being quickly shifted as the tactical situation required. His inspired leadership and conspicuous devotion to duty in rendering such meritorious service are in keeping with the highest traditions of the armed forces."

Col. Charlton, a member of Troop D, Texas National Guard, served in the Big Bend district during the Mexican border incident of 1916. He was commissioned a second lieutenant in the infantry in 1918 and left active duty the following year with the rank of first lieutenant. He remained in the Officers' Reserve Corps and held the rank of major when called to active duty in March, 1941.

The colonel was born at Brazoria, Tex. His parents moved to San Antonio where he attended public schools and San Antonio Academy. He has been a member of the American Legion since 1920 and is past commander of Alamo Post No. 2, San Antonio. He is also a member of the Austin Masonic Lodge and of the Del Rio Lions Club. His wife, Mrs. Undine Charlton, lives in Del Rio. A son, 2nd Lieut. Marvin Charlton, Jr., is on duty with the Air Forces. The Charlton's daughters, Mrs. Kurt Brandenstein and Mrs. Undine B. Sein, both live in Del Rio.

## It's Travel Bureau Time Again as Restrictions Fade into the Past

The travel bureau is coming into its own once more. After four years of wartime restrictions. Americans want to resume one of their favorite pastimes—automobile traveling. In tempo with the trend, travel bureaus are being rejuvenated. Standard Oil Co. of Ohio is among the first of the oil companies to renew its travel bureau service. The story of Sohio's new bureau appears on page 19.

**Start the New Year Right...**
**Resolve to...**

# *Install TOKHEIM 4-Season Pumps*

*Model 39 Computers with Hose Reel*

● If you want to start the New Year right and make a profit by so doing, resolve now to put Tokheims on your islands in 1946. Old pre-war equipment will not do the job in the new post-war world. New Tokheims will bring in new customers and serve the old better, faster, more economically. These famous Tokheims are now rolling off the assembly lines at a steadily increasing rate. But there are many orders waiting to be filled and more arriving daily. So if you want Tokheims in '46, better place your order soon. Call your Tokheim man or write the factory today for complete information and literature.

QUALITY TOKHEIM
THE 4-SEASON PUMP

**TOKHEIM OIL TANK AND PUMP CO.**
DESIGNERS AND BUILDERS OF SUPERIOR EQUIPMENT
FORT WAYNE 1 FOR 45 YEARS INDIANA

**ETHYL CORPORATION**

# ● research laboratories

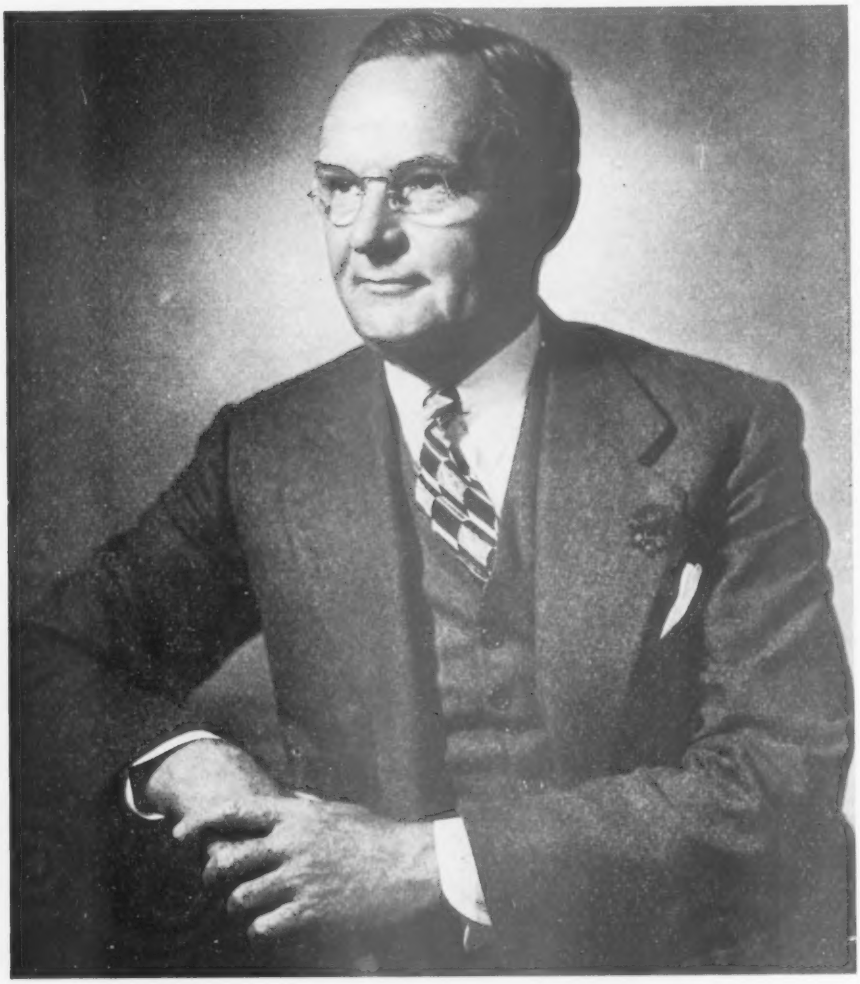
**1600 West Eight Mile Road, Detroit**

With removal of wartime restrictions, the Ethyl Corporation is now able to extend a cordial invitation to its friends to visit its new research laboratories at 1600 West Eight Mile Road, Detroit.

Designed specifically for research and development on the interrelated problems of gasoline engines, fuels and lubricants, these new laboratories have much in the way of special equipment and unique features which make them interesting to technical people in both the automotive and petroleum industries.

**ETHYL CORPORATION, CHRYSLER BUILDING, NEW YORK, NEW YORK**

# Jersey Standard Chairman Knows His Oil, Men and Vegetables



*Frank W. Abrams*

The man who's been working on the development of the zippered lima bean can look to whatever laurels he may have acquired. In any event, he'll have to hurry if Jersey Standard's new board chairman, Frank W. Abrams, isn't to beat him to the punch with the natural mashed potato—or some similar refinement upon nature.

Mr. Abrams has the happy faculty of keeping his head in some of the loftier pinnacles of business, and his feet on some rather fertile ground down at the end of Long Island. This is his own "little bit of New England," a miniature farm of 10 acres near a place called Mattituck. In just a shake, he can put New York's towers behind him and be in just the kind of environs he knew and loved as a boy.

He does just that in what spare time is granted him. Certain of his neighbors whom he describes as "serious" farmers raise potatoes, cauliflower and Brussels sprouts, but he goes in for berries and asparagus, when he's not conjuring up visions of horticultural curiosities like the aforementioned potato.

He finds it refreshing, and his associates and many acquaintances in the industry and in Washington find Frank Abrams "solid folks". Around the office, they say he knows more people by their first names in the refineries than he does in the office.

On this trait, his company now can capitalize more than it ever has before. In his new position, Mr. Abrams is expected to have more freedom to circulate, and more people will be basking in his New England neighborliness.

While he came by this naturally, having been born in Rockville Center, L. I., in 1889, he got into the oil business by going off the professional path he followed through Syracuse University—civil engineering. The youthful Abrams, in 1912, couldn't see himself knocking about, bearing a transit level, in foreign parts, no matter how exotic or romantic those might be.

"A job in the hand," he concluded, "is worth two in the jungle." The Standard Oil Company (New Jersey) has had him ever since.

He worked first as a draftsman in the company's Eagle Works at Jersey City. Five years later, he was assistant superintendent of that installation, and three years after that was superintendent. Subsequently, he became manager of the Eagle Works and of the company's Parkersburg, W. Va., refinery.

His leadership in the development of oil refining was acknowledged by 1926 with his appointment as head of all the company's refining operations in the New Jersey area.

Mr. Abrams was elected president of Jersey Standard's principal domestic refining and marketing affiliate in 1933, named to the company's board in 1940 and made a vice-president in 1944.

Church, the Union Club, golf and reading claim many of his hours outside of business which are not devoted to truck gardening. He is an avid reader, and is collecting a sizable library.

## BULLETIN

### TANKER SITUATION BETTER

**WASHINGTON—The tanker manning problem was "beginning to look a lot better" this week. War Shipping Administration said. WSA reported that field agents were receiving many applications from absentee crew members who wanted to return to duty.**

**Belief was expressed that the entire problem might be ended this week, permitting tied-up tankers to sail.**

## CONTENTS


| | |
|---|---|
| Advertiser's Index | 48 |
| Coming Meetings | 50 |
| Editor's Page | 11 |
| Markets | 39 |
| Oil Orders | 35 |
| Oil Prices | 40 |
| Oil Transportation | 14 |
| Personals | 50 |
| Pipelines | 8 |
| Production News | 37 |
| Refining News | 22 |
| Statistics | 44 |
| Welcome Back | 28 |


NATIONAL PETROLEUM NEWS, January 2, 1946, Vol. XXXVIII—No. 1 Published every week at 1213 West 3rd St., Cleveland 13, Ohio, U. S. A. Subscription rate $5.00 per year in United States, Mexico, and Pan-American countries; $6.50 Canada and foreign countries. Entered as second class matter Jan. 17, 1910 at Cleveland, O., post office under act of March 3, 1879, by the National Petroleum Publishing Co. Copyright 1946 The National Petroleum Publishing Company.

NATIONAL PETROLEUM NEWS
NPN
NEWSMAGAZINE FOR OIL MANAGEMENT MEN

# PAW Moves to Ease Fuel Oil Supplies As Military Use Cuts East Coast's Stocks

## Navy's Fuel Oil Requirements 130,000 B/D More Than Expected; Severe Spot Shortages Seen for Domestic, Industrial Users

By Herbert A. Yocom
Chief, NPN Washington Bureau

WASHINGTON—A badly deteriorated fuel oil situation prompted a sudden revival of activity on the part of PAW this week and foretold the possibility of that agency again being compelled to direct the movement and distribution of supplies to eastern and other consuming centers.

At base of the trouble is a first quarter Navy requirement for 130,000 b/d more Navy special fuel oil than had been anticipated, largely due to use of warships for return of armed forces from the Pacific, plus the further fact that Navy liftings in the last quarter of 1945 exceeded programmed levels to cause a heavier than expected draft on stocks.

Other contributing factors include deviations from expected refinery performances, and a "holiday walk-off" of tanker crews which resulted in tieing up of 35 tankers at Dist. 1 and Gulf Coast ports.

### Military Worried

Latter situation was a special cause of concern to the military, whose overseas bases are being supplied by less than the number of tankers considered necessary for a proper margin of safety. In this connection, Army-Navy Petroleum Board reported to War Shipping Administration that failure of tankers to sail on schedule was threatening an already "critical" supply position in the eastern theater of operations, particularly with respect to motor gasoline. The Army, A-NPB said, has only a "few days" supply left in northwest Europe to balance against a possible complete cessation of supplies.

Causing PAW brows to wrinkle was the threat to the Dist. 1 supply of fuel oils for domestic and industrial use if direct measures now being considered fail to relieve the pressure which results from high demands for Navy special.

Frankly viewing the outlook as serious, with spot shortages of increasing severity definitely in prospect for the East Coast from now on through March even if these measures succeed, PAW took the first preparatory step towards possible resumption of supply control by requesting the Dist. 1 Industry Supply Committee to reactiviate its statistical force and begin again the compilation of supply figures for all seaboard terminals.

### Lack of Personnel in PAW

Final decision on moves that should follow, if any, may not come for another several days, however—after PAW has consulted more fully with industry.

Although handicapped by lack of personnel—the agency's Washington staff already has been whittled down from a war-time peak of 1,480 to only 165, and district offices have gone completely out of business—PAW was wasting no time, meanwhile, in its attempt to find some way of meeting the Navy's requirements for special fuel oil.

Navy now is getting 61,000 b/d more Navy special than PAW had been informed would be required in the first quarter and wants 69,000 b/d on top of that. This means that the total anticipated program for Navy special is off 130,000 b/d, the total requirement of 206,000 b/d comparing with PAW's first quarter demand estimate against California, Gulf Coast and Caribbean of only 76,000 b/d, as shown by following chart (in bbls. per day):

| | Dist. 5 | Dist. 3 | Caribbean |
|---|---|---|---|
| PAW Program | 56,000 | 0 | 20,000 |
| Navy Wants | 106,000 | 50,000 | 50,000 |
| Navy Now Getting | 64,000 | 40,000 | 33,000 |

If at all possible, PAW hopes to throw as much of the excess Navy demand on California as it can, even if increasing yields of Navy special by 42,000 b/d means that crude production from California fields will again have to be shoved up past the MER. Whole situation in this respect is to be canvassed at a meeting scheduled for Los Angeles Jan. 4 with refiners and producers.

### Follow Navy Suggestion

In other directions, following up a PAW suggestion, Navy already is contacting Rocky Mountain refiners and expects soon to start movement of from 12-14,000 b/d of Navy special and Bunker C (about half-and-half) to Navy-owned or leased facilities in the Portland-Seattle area. Such a movement will relieve San Francisco Bay refiners from necessity of supplying this volume, but cannot be started until OPA acts on request of Rocky Mountain refiners for restoration of price ceilings that prevailed at time the Jap war ended and which since have been revised downward.

According to Navy, there is no doubt about product being available in Dist. 4 and one refiner—Husky Refining Co., largest in the area—already has advised it that it will move immediately to reopen its refinery at Riverton, Wyo.

Again at PAW suggestion, Navy also hopes to pick up about 15,000 b/d additional in Persian Gulf area as soon as the British reopen a field topping plant of that capacity, as they have indicated they will do. All other refining facilities in the Gulf already are operating at maximum.

PAW had indicated, too, that a considerable volume of Navy special might be obtainable in inland Dist. 3 and parts of Dist. 2, but Navy isn't very interested so far because of the high transportation costs it would have to absorb. Besides, it would want the product laid down on the Gulf and that would necessitate establishing more dirty storage which now isn't available.

# Move to Reactivate Dist. 1 S. & T. Committee as Relief Measure in Current Fuel Oil Shortage

NPN News Bureau

NEW YORK—Steps toward stop-gap reactivation of District 1 Supply and Transportation Committee as a relief measure in the fuel oil stringency were being taken this week as the industry strove to prevent hardships to users in the face of unusual shipping delays.

Inactive since expiration of PAW's Directive 59, the committee, headed by B. I. Graves of Tide Water Associated Oil Co., had been asked to lend its services for the emergency, and prospects were that it will seek current information as to stocks in various terminals.

Requests for some of its members to return here for the reporting task and for companies to resume certain reports were being considered at NPN press time, with the likelihood of definite action in a day or two. Robert Hunter of Gulf Oil Corp., who headed the committee's operating division, probably will be asked to come here from Pittsburgh.

The situation on the east coast was "tighter than a drum", as one company official put it, particularly as to kerosine, while some suppliers asserted residual stocks were as low as kerosine and distillates. At the same time, another supplier here said he was having no trouble getting No. 2 fuel oil.

Boston, where some important suppliers' stocks were exhausted last week, was being relieved by the routing there of barges and tankers by some companies.

The observation was general that it was too early for any effects of the recent price increases to be apparent, but those were "disappointing", and little optimism was expressed on this score. However, with the holidays over, tankers delayed at the Gulf by manpower difficulties were expected to be moving again.

At the same time, an officer of a major company here said of the situation generally that a shortage is only threatened, and the company hoped to "make the

grade" even though a severe cold spell should develop.

Charting of statistics moved the economist for another company, A. J. McIntosh, Socony-Vacuum, to observe "the supply seems to be exceeding what our estimates indicated, but kerosine stocks look like they're lower than they should be in view of a fairly good-looking production figure." He suggested one or two or all of three factors might be aggravating the situation.

## Shortage of Tanker Crews Holds up Fuel Shipments

*Special to NPN*

HOUSTON, Tex.—A shortage of crews for tankers plus a congestion in Texas ports helped contribute to the current fuel oil shortage in the North and East.

As regards the crews, there is no evidence of any organized strike nor is there any labor trouble out in the open, but the fact remains that many tankers are tied up because there are no men available to sail them.

One oil company executive said his firm has had no tanker trouble but added he understood several others have had. He said many tankers are being diverted from the Pacific coast and when they reach the Gulf ports the crews jump ship, leaving the craft undermanned.

J. Russell Wait, captain of the Port of Houston, said he did not know just what the trouble was but he did know that there were many tankers in the Port of Houston and also in the channel below Houston which had been there longer than usual. He said he knew of one tanker which had signed on crews three or four different times only to have them disappear before sailing time.

He attributed part of the delay to an unusual concentration of shipping and a very heavy movement of oil. He said many times a tanker will have to anchor in the channel because there is no dock space available. He said there are some 115 ships of all types in the channel now, although not all of them are tankers and not all are having crew trouble. He declared the dock facilities at the Port of Houston are already completely booked for January.

In Austin Col. Ernest O. Thompson, Texas Railroad Commissioner, said it was his belief that a shortage of fuel oil type crude at the Texas shipping terminals is chiefly responsible for the fuel oil shortage in the East. Col. Thompson said that up to this point refineries have been working full blast on gasoline, which requires a different base crude and that time is needed to produce, transport and process the fuel oil crude which is now in such demand.

The Texas Commission for January ignored a Bureau of Mines estimate and raised its allowable to 2,027,175 b/d which is 252,175 over the Bureau's estimate. Practically all of this increase is for fuel oil crude but the new allowables were not effective until Jan. 1.

# Price Main Factor In Tight Fuel Oil Supply, Says Ickes

NPN News Bureau

WASHINGTON — PAW Ickes said last week the "prime reason" why the supply of fuel oil is tightening "appreciably" is that oil companies "make real money from gasoline," and they prefer to make more gasoline and less fuel oil from a barrel of crude.

A "stringency" in fuel oil as well as coal is a possibility, he told a press conference.

Asked whether price of crude or price of fuel oil should be increased to correct the supply situation, Mr. Ickes declined to comment because, he said, "PAW is practically in suspense now—we're not operating." He recalled, however, that in the past he had advocated an increase in the price of crude.

Concerning a wire sent by B. L. Majewski to the White House asking that a committee be appointed to study fuel oil situation in Midwest, Mr. Ickes said the communication had not been referred to him for consideration.

Other highlights of press conference comments were:

CONSERVATION—Asked whether he had taken any steps toward postwar expansion of Interior's Petroleum Conservation Division, Mr. Ickes replied that discussions had been held among Interior officials on this subject, but that final action had not been taken and "may depend on the President's reorganization bill.

### Favors Expansion

"I think it (PCD) ought to be expanded," he added, "I think it ought to take over all records of PAW and have a more active function than it has had heretofore."

TIDELANDS — Passage of quitclaim resolution would set a "bad precedent," but there is no question that Congress has the right to pass this or any other law to "give away federal property." In the same connection, he expressed resentment that Welburn Mayock had organized the protest of Attorneys General who demanded passage of the quitclaim resolution. Tidelands issue is "none of his (Mayock's) damned business," Mr. Ickes declared, expressing wonder that a person such as the "judge," who is connected with Democratic National Committee, should concern himself with this issue. But also said he'd like to find out who is paying Mayock's expenses.

### Affects Oil, Not States

Tidelands issue is one that affects oil rather than state's rights, Mr. Ickes asserted, adding that "otherwise Kenny (Attorney General Kenny of California) wouldn't have become to excited about it." Informed that the attorney generals of both Mississippi and Missouri had reversed their stand on Tidelands and now opposed passage of quitclaim resolution, he said they "are to be highly commended for changing their stand," because "that is not an easy thing for a man in public life to do."

BROWN LETTER — His attention called to a letter sent out by Russell Brown, general counsel of the Independent Petroleum Assn., which claimed the independents were not adequately represented on either PAW or P.W.I.C. Mr. Ickes said he had not seen the letter, "but as a matter of fact numerically there were more independents than majors (represented in PAW and P.I.W.C.). We did try to make P.I.W.C. balanced between majors and independents, and I don't see why anyone wants to complain about it now."

Mr. Ickes also recalled that at the A.P.I. convention in Chicago there was some discussion of "some form of continued co-operation (on the part of the oil industry) with the government" but that he did not know whether such an organization would divide "majors and minors."

"I did my job (as Petroleum Administrator) and ran off so quickly they were dizzy," Mr. Ickes continued.

When one reporter suggested that some industry men believed "you let go too soon," Mr. Ickes said:

"You never can please them. You know, the complaint was that I was going to take over the oil industry. Now they claim I let go too soon. Well, God bless them."

## Seeks 40,000 B/D Increase In Dist. 5 Navy Special

NPN News Bureau

WASHINGTON—Possibility of stepping up Dist. 5 crude runs to produce 40,000 b/d additional of Navy special fuel oil will be explored at meeting with refiners to be called by PAW for Los Angeles Jan. 4.

The move grows out of the tight supply situation resulting from recent upping of Navy special requirements by 2,000,000 bbls. per month over what had been anticipated at the time the last PAW supply program was drawn up. Present availability on West Coast is such that Navy has had to commence heavy lifting from Gulf Coast and Aruba, thus cutting into supply originally scheduled for movement to Dist. 1.

Other actions in the wind, following a joint PAW-Navy discussion last week, include recommencement of Navy shipments from Dist. 4 to West Coast to extent of around 18,000 b/d, provided rails, already burdened with heavy troop train movements, can handle that volume.

Another possibility being actively explored with British, NPN was informed, is that of stepping up fuel oil shipments from the Persian gulf.

Meanwhile, there have been no policy determinations by PAW on possible need for reinstating partial controls over supply and distribution until present situation eases.

## Ceilings on Fuel Oil Won't Be Removed Now, Says Bowles

NPN News Bureau

CHICAGO—Present price ceilings on fuel oil and other petroleum products will not be removed now, Chester Bowles, OPA, has written B. L. Majewski, former chairman of Dist. 2 and P.I.W.C. Marketing Committees. Adjustment upward of ceilings on fuel oils may be possible after meeting of OPA with Refining Committee here Jan. 4, it was said.

Refiners report the increase in ceilings on coast is causing abnormal draft on supplies in Midwest, which is adding to shortage already felt here. Increase in ceiling in Dist. 2 is imperative if serious shortage is to be avoided, they declare. Dist. 2 refinery runs are now down to 1,130,000 to 1,150,000 bbls. per day and consumption of all products totals 1,250,000 b/d. Refinery runs should be at least 1,175,000 b/d with inshipments taking care of difference.

Many small refineries are now clogged with surplus gasoline stocks. Prices reported unprofitable. Refiners cannot manufacture middle distillate only at present ceiling prices.

"if necessary to grant refiners an increase in ceilings on burning oils to assure adequate supply" said C. R. Jonswold, chairman, distribution division, Oil Heat Institute, "OPA should provide for passing the increase on to consumers without necessity of distributors having to make individual hardship applications. Distributors are now having to pay longer transportation hauls because of scarcity of supply, which adds greatly to their present costs."

Glenn A. Primm, executive secretary, Illinois Petroleum Assn., also declared that if the East Coast is robbing the Middle West of it's supply of fuel oil "we must fight for the increase in ceilings. If a higher price on burning oil will help to take the surplus of gasoline off the market, then we ought to have it," he added.

## Meetings Planned On Distillate Shortage

NPN News Bureau

WASHINGTON—The middle oil distillate shortage as it affects Dist. 2, and also the export situation will receive consideration within a week. On Jan. 4 in Chicago a subcommittee of OPA's National Refiners' Industry Advisory Committee will discuss the Dist. 2 shortage. OPA also plans to call a meeting of interested government agencies during the week of Jan. 7 to consider adjustments of the export situation.

Sidney A. Swensrud, vice president of Ohio Standard, is chairman of the subcommittee meeting in Chicago.

Other members are Max M. Fisher, vice president, Aurora Gasoline Co., Detroit; John W. Boatwright, manager of Sales Research Department, Indiana Standard; Roland V. Rodman, vice president, Bay Petroleum Corp., Denver; C. A. Johnson, chairman, Socal Oil and Refining Co., Huntington Beach, Calif.; R. L. Tollett, president, Cosden Petroleum Corp., Big Spring, Tex., and Stewart P. Coleman, head, economics department, Jersey Standard.

The OPA meeting in Washington is due to the fact, OPA said, that the present export situation could not continue, and a permanent policy must be devised.

At the present time, practically no kerosine or heating oils are being exported from the Gulf Coast because OPA's recently-announced price increases do not apply on shipments for export or to exporters.

OPA also disclosed it had sent copies of East Coast Fuel Oil Industry Advisory Committee report to all military purchase branches, in an effort to call attention to the committee's recommendation that military forces be requested to procure as much as possible of their requirements from points of surplus, if any, in interior parts of the United States and relieve pressure on Districts 1 and 3.

## 2 More Settlements Made at 18%; Other Negotiations Still On

NPN News Bureau

WASHINGTON—With the oil wage panel standing aside until Jan. 7, negotiations were being conducted beween oil companies and locals of the Oil Workers International Union at practically all of the plants at which strikes were called last fall. During the past week the following settlements were added to those previously reported (NPN Dec. 26, p. 6; NPN Dec. 19, p. 5):

California—Shell Oil Co. of California and O. W. I. U. locals reached an agreement calling for an increase, effective Jan. 1, in hourly wage rates of 18% based upon September scales. A retroactive increase of 15%, also as figured on September rates, will apply on wages paid from Oct. 31 through Dec. 31, 1945. The agreement also provides for 4-cent and 6-cent an hour differentials for the evening and night shifts, respectively. Five OWIU locals in California will meet jointly on Jan. 7 to ratify or reject the agreement.

Oklahoma—The Oklahoma division of the Texas Pipeline Co. and the OWIU local there on Monday signed a contract providing for an 18% increase in hourly rates. According to OWIU Vice President A. R. Kinstley, who announced the agreement, the question of shift differentials was not included in the contract.

A proposed contract between The Texas Co. and OWIU local at Lockport, Ill., was rejected by members of the union on Dec. 28, according to Park Widner, local president. The union now is drafting a counterproposal to be submitted to the company later this month.

## Socony-Vacuum East, Central Marketing Divisions United

NPN News Bureau

NEW YORK — Election to board of directors of Socony-Vacuum Oil Co., Inc., of John F. Seal and C. Francis Beatty and consolidation of company's eastern and central marketing divisions have been announced with retirement Dec. 31 of Arthur T. Roberts and Charles E. Arnott.

Vice president Walter I. Faust, in charge of eastern marketing since 1938, will direct the combined operations, and Mr. Beatty will be associated with him. Heretofore, Mr. Arnott supervised central marketing activities.

Mr. Seal, assistant treasurer since 1931, succeeds Mr. Roberts as treasurer. He entered the employ of Vacuum Oil Co. as assistant treasurer in 1924, previously having been treasurer of Farmers Trust Co., Mount Holly, N. J., and, from 1920 to 1923, having been a national bank examiner.

A graduate of Harvard, class of 1917, and a second lieutenant with the AEF in World War I, he has been active in community affairs of Leonia, N. J., and was mayor in 1938-39. He is a director of Leonia Bank & Trust Co., and member of Harvard Club of New York City.

Mr. Beatty, native of Brooklyn, was graduated from Amherst in 1912 and went to work for Standard Oil Co. of New York at Pratt Refinery in Long Island City. From 1915 to 1928 he was associated, in turn, with Knox Hat Co., New Jersey Zinc Co., and F. J. Ross Advertising Agency.

In 1928, he returned to Standard of New York as manager of the paint department.

His clubs include Anglers of New York, Amherst, Lawyers, Quaker Hill Country Club, Pawling, N. Y., and Town Club of Scarsdale.

## Jennings Views Petroleum Industry's Postwar Role

NPN News Bureau

NEW YORK—B. Brewster Jennings, president of Socony-Vacuum Oil Co., Inc., sees the petroleum industry in 1946 participating in "many phases" of postwar reconstruction and reconversion, including increased activity in such fields as Diesel engines, road building and home construction as well as automobile and airplane manufacture.

Construction activities alone should result in requirements for hundreds of millions of dollars worth of petroleum fuels, lubricants and specialties, he said in a statement this week.

He expects about 500,000 private and commercial aircraft to be in use or under construction in U. S. by 1953, while as many as 2,000,000 tons of petroleum asphalt may be used in the next 12 months on new road and street construction, he said. Programs to make up for delayed highway maintenance, he added, probably will require some 6,000,000 tons of petroleum asphalt.

## Sun Oil Plans to Produce Carbon 13

*Special to NPN*

PHILADELPHIA — Sun Oil Co. and Houdry Process Corp. this week announced plans for construction of two plants to produce Carbon 13 in substantial quantities.

Carbon 13 is a rare heavy carbon isotope found to have great value in biochemical research as a "tracer" and gives promise of "ranking in importance with X-Ray as a tool of medical science," the joint statement pointed out.

The announcement follows two years of research and experiment. "The possibilities of research with Carbon 13 are almost beyond imagination", it is said in a statement issued by the two companies. "It is a new and powerful tool for a revolutionary approach to studies of the fundamental processes that occur in all living things, as well as metabolic disease processes such as cancer, diabetes, hardening of the arteries, so-called 'heart trouble' and others."

It was the belief and interest in the roll of catalysis in body functions long held by Eugene J. Houdry, president of the Houdry Process Corp., that originally led to the association of Houdry Process Corp. with the Lankenau Hospital Research Institute, in research on cancer.

**Will Raise World Supplies**

World supplies of Carbon 13 will be increased from 500 to 1,000 times with the duplication of an existing thermal diffusion plant to be built for Sun at the Houdry laboratories and a second plant, considerably larger, at Sun's Marcus Hook refinery, according to Arthur E. Pew, Jr., vice-president of Sun, and Eugene J. Houdry and Arthur V. Danner, president and executive vice-president, respectively, of Houdry.

At the same time, they added, it is hoped cost of production will be brought down from about $400 a gram to about $40, and plans are to make the product available without cost to "qualified, noncommercial biological and medical research organizations whose activities and experience justify such donations."

The Houdry experiments started with less than one-half gram which cost several thousand dollars to concentrate.

Carbon 13 is used to prove the secrets of metabolic disease processes, such as cancer, diabetes, hardening of the arteries and heart trouble. Carbon 13, it was explained, may be compared to a chemical microscope that makes it possible for the chemist to see and follow chemical reactions in the body, which is not possible with X-Ray.

Particular efforts are being made with Carbon 13 to discover the cause of cancer.

Houdry's present plant is producing about one-fourth gram per month. This material has been made available without cost to members of the Isotope Research Committee for distribution to biochemical research institutions.

A number of distinguished scientists, many of whom worked on development of the atomic bomb, have contributed in one way or another to the Houdry-Sun Carbon 13 project, according to the announcement.

The work was initiated and carried on by Dr. Aristid V. Grosse of the Houdry organization, assisted by Dr. E. A. Smith, Houdry research director, Dr. Stanley P. Reimann, director of the Lankenau Hospital Research Institute of Philadelphia and others in those two organizations.

Sun has cooperated in financing the biological work since January, 1945. The Isotope Research Committee was organized last June as a group of distinguished scientists for sponsoring and assisting nationwide biological, biochemical and chemical research with isotopes of carbon and other elements.

A relatively new laboratory instrument used by oil companies in the routine analysis of hydrocarbon compounds, the mass spectrometer, is also used in medical research with Carbon 13. There are about 30 of these instruments in use in this country, most of them owned by oil companies. Many of these oil companies, it is stated, have already agreed to make their mass spectrometers available to institutions carrying on the biochemical research with heavy carbon.

## Shell Chemical Corp. Formed; Oostermeyer Named Head

NPN News Bureau

NEW YORK—Shell Chemical Corp. has been incorporated in Delaware to take over business of Shell Chemical Division of Shell Union Oil Corp., J. Oostermeyer, who heads new concern, announced this week.

Shell Chemical Corp. will be a wholly-owned subsidiary of Shell Oil Co., Inc., he added. Head office will be in Shell Building, San Francisco, and a New York office will be maintained at 500 Fifth Ave.

As well as continuing operation of three chemical plants in California at Shell Point, Martinez and Dominguez, the new corporation later will take over operation of Shell Oil's chemical plant in Houston, Tex. It will continue operation of the butadiene plant at Torrance, Calif., for the Office of Rubber Reserve.

Expected to employ about 2,000 persons, it will, said Mr. Oostermeyer, "be directed towards the further development of petroleum derivatives throughout the country."

He, A. E. Lacomble, W. P. Gage, L. V. Steck and J. W. Watson, all of San Francisco, make up the board of directors. Officers besides Mr. Oostermeyer are: Mr. Gage and Mr. Steck, vice presidents; Mr. Watson, treasurer; J. Rysdorp, secretary; P. T. Vockel, and assistant treasurer, and J. G. M. Selden, Jr., assistant secretary.

## New Firm Formed by Merging of Freedom, Valvoline and Galena

*Special to NPN*

FREEDOM, Pa. — Announcement of the formation of a new company—the Freedom-Valvoline Oil Co., with the merger of Freedom Oil Co. here and Valvoline Oil Co. and Galena Oil Corp., both of Cincinnati, was made this week by William G. Bechman, board chairman of the new company. The new company will maintain headquarters here and in Cincinnati, and refining activities will be maintained in two plants located at Butler and Freedom, Pa.

Officers of the new company are as follows: Mr. Bechman, chairman of the board; Gus P. Doll, vice chairman of the board and executive vice president; Earle M. Craig, president; C. J. Leroux, vice president in charge of sales; B. L. Heath, vice president in charge of manufacturing; C. Lloyd Archer, secretary-treasurer.

The consolidation brings together the three oldest independent Pennsylvania refiners of lubricating oil, all of them distributing their products internationally, the announcement said.

Between the three companies are claimed the distinction of creating the first lubricating oil refinery in the world; pioneering the continuous process of oil refining; providing the first practical lubrication of both the Corliss steam engine and the Parsons steam turbine; refining the first lubricant ever specified by American railroads; lubricating Elwood Haynes' famous first American automobile; first marketing nationally lubricating oil in sealed metal cans; and the first manufacture and marketing of an all-season, all purpose gear lube.

The Valvoline Oil Co. was founded in 1866 by Dr. John Ellis and takes credit for fathering the lubricating oil refining industry as known today.

Galena Oil Corp., originally known as the Galena Oil Works, Limited, located at Franklin, Pa., was founded in 1869 by Gen. Charles Miller and Joseph C. Sibley. It played an important part in railroad pioneering by providing lubrication for much of the earliest rolling stock. It pioneered in the method of railroad marketing on a mileage basis.

Freedom Oil Co. was founded in 1879 by Dr. Stephen A. Craig. From a very modest beginning, it has a record of prosperity and expansion and has never lost its identity nor its reputation for refining the highest quality crude by the most approved methods.

## Heads Dallas Geological Group

*Special to NPN*

DALLAS — John W. Clark of Magnolia Petroleum Co., has been elected president of the Dallas Geological Society by a mail vote of the 150 members of the association.

## Boyd Names 40 as Members of Enlarged General Committee of API's Division of Marketing

NPN News Bureau

NEW YORK — API president William R. Boyd, Jr., this week announced membership of an enlarged general committee of API's division of marketing to serve until the institute's next annual meeting, scheduled for Nov. 11-14.

Membership of committee was increased from 25 to 40 "to permit wider representation and a more comprehensive approach to the problems of supply and distribution which confront the industry."

Eric V. Weber, Eureka Oil Co., Cincinnati, O., vice president for marketing of API, is ex-officio chairman of the general committee. Members are:

Fred G. Bannerot, Jr., Elk Refining Co., Box 1033, Charleston 24, W. Va.

C. M. Barringer, North Carolina Jobbers Assn., Newton, N. C.

A. Clarke Bedford, Standard Oil Co. of N. J., 26 Broadway, New York.

Roy W. Blair, Lincoln Oil Co. (National Oil Marketers Assn.) Troy, Mo.

W. C. Burns, Richfield Oil Corp. of N. Y., 19 West 50th St., New York 20.

Royal E. Decker, Plymouth Oil Co., (Michigan State Jobbers Assn.), 14105 Plymouth Road, Detroit 27.

W. T. Dinkins, Richfield Oil Corp., 555 S. Flower St., Los Angeles 13.

J. E. Dyer, Sinclair Refining Co., 630 Fifth Ave., New York 20.

S. B. Eckert, Sun Oil Co., 1608 Walnut St., Philadelphia 3.

Walter L. Faust, Socony-Vacuum Oil Co., Inc., 26 Broadway, New York 4.

H. E. Hanson, Standard Oil Co., (Indiana), 910 S. Michigan Ave., Chicago 80.

C. Z. Hardwick, the Ohio Oil Co., 539 South Main St., Findlay, Ohio.

John Harper, Harper Oil Co., Inc., (Empire State Petroleum Assn.), 29-28 41st Ave., Long Island City 1, N. Y.

A. M. Hughes, Phillips Petroleum Co., Bartlesville, Okla.

H. J. Kennedy, Continental Oil Co., Ponca City, Okla.

Jess Knowles, Skelly Oil Co., 2534 Madison St., Kansas City 10, Mo.

P. E. Latkin, Shell Oil Co., Inc., 50 W. 50th St., New York 20.

C. L. Mayhall, Anderson Prichard Oil Corp., Oklahoma City.

Joseph L. Nolan, Farmers Union Auto Exchange, Box G, St. Paul, Minn.

Ray M. Parker, Hartol Products Corp., 630 Fifth Ave., New York 20.

T. S. Petersen, Standard Oil Co. of California, 225 Bush St., San Francisco 20.

A. F. Reed, Lion Oil Co., El Dorado, Ark.

M. H. Robineau, Frontier Refining Co., Cheyenne, Wyo.

R. J. Rogers, Indiana Independent Petroleum Assn., Inc., suite 1404, 108 E. Washington Bldg., Indianapolis 4.

W. F. Roth, Standard Oil Co. of Ky., Louisville.

R. L. Saunders, The Texas Co., 135 E. 42nd St., New York 17.

J. W. Scott, Buckley & Scott Utilities, Inc. (Atlantic Coast Oil Conference, Inc.), Watertown, Mass.

A. A. Stambaugh, the Standard Oil Co. (Ohio), Midland Bldg., Cleveland 15.

A. C. Stewart, Union Oil Co. of Calif., 617 W. 7th St., Los Angeles 14.

Hugh L. Thatcher, Thatcher Oil Co., (National Council of Independent Petroleum Assn's.) 57th St. & Tennessee Ave., Chattanooga 1, Tenn.

Burl S. Watson, Petroleum Advisers, Inc., 70 Pine Street, New York 5.

C. B. Watson, the Pure Oil Co., 35 East Wacker Drive, Chicago 1.

Russell S. Williams, Gaseteria, Inc., (Individually Branded Petroleum Assn., Inc.), 1031 E. Washington St., Indianapolis 8.

Wayne C. Yeager, the Atlantic Refining Co., P. O. Box 7258, Philadelphia 1.

K. W. Yeates, Wasatch Oil Refining Co., 803 McIntyre Bldg., Salt Lake City.

B. I. Graves, Tide Water Associated Oil Co., 17 Battery Place, New York 4.

W. V. Hartmann, Gulf Oil Corp., P. O. Box 1166, Pittsburgh 30.

Robert W. McDowell, Mid-Continent Petroleum Corp., P. O. Box 381, Tulsa 2.

B. L. Majewski, Deep Rock Oil Corp., P. O. Box 725, Chicago 90.

W. K. Warren, Warren Petroleum Corp., Tulsa 3.

### Export Shipments of Kerosine Limited by Commerce Dept.

NPN News Bureau

WASHINGTON—In a step which officials described as a "precautionary" measure, the Commerce Department's Office of International Trade Operations has limited export shipments of kerosine under general license to $100 for Allied and friendly neutral nations and prohibited all kerosine export under general license to enemy countries.

The action, effective Jan. 1, does not apply to distillates, but includes burning oils, mineral colza, petrolite, and signal oil.

ITO said it had not received any request from PAW or OPA to control exports of kerosine, but took the action as a "precaution" in view of the current shortage, and had not heard of OPA's plan to call a conference on the middle distillate export problem.

At the same time, eight other types of petroleum products were removed from the positive list and placed under general license for export to all group K countries (Allies and friendly neutrals). as follows:

Medium-octane motor fuels of which the total fraction obtained by commercial distillation having an ASTM end point of 300°F. or lower will have, with the addition of 3 cc. tetraethyl lead per gal., an octane number by the ASTM knock test method of 80 or more; other motor fuel and gasoline from which by commercial distillation there can be separated more than 3 per cent of a total fraction having an ASTM end point of 300°F. which will have, with the addition of 3 cc. tetraethyl lead per gal., an octane number by the ASTM knock test method of 80 or more; other motor fuels and gasoline not conforming to specifications for the two above-named groups or to Department of Commerce Schedule B No. 501605.

Slack waxes; indralatum wax; plasticrude wax; substitute mineral waxes derived from petroleum bases (including microcrystalline waxes, petrolatum waxes and tank bottom short fiber waxes); and all other slop waxes.

## Meeting Called to Study Independent FTC Brief

NPN News Bureau

CLEVELAND—E. V. Weber, Cincinnati, has announced that a meeting will be held Jan. 9 at Columbus to study the brief now being prepared by Attorney Hubert B. Fuller here for submission to Federal Trade Commission outlining the objections of National Council of Independent Petroleum Assns. to the Federal Trade Commission's ruling in the Standard Oil Co. (Ind.) case (Docket 4389).

Mr. Weber said he called the meeting, which will be attended by H. L. Thatcher, council president, Mr. Fuller, and a committee from the Ohio Petroleum Marketers Assn., of which he is president, to go over the brief for correction or approval.

The brief is to be submitted to FTC before a hearing of the case on Feb. 23 at the suggestion of an FTC attorney to H. L. Thatcher, president of the council, and E. V. Weber, chairman of a committee of five appointed by N.C.I.P.A. to study problems raised by the Detroit order.

After discussion of the brief at the Columbus meeting, it will be taken to Chicago, where a meeting will be held some time during the week of Jan. 13 by the Council for further study and approval before its submission to FTC.

FTC first asked Council President Thatcher to submit a written statement outlining the council's stated belief that the order would adversely affect independent marketers. The commission later made the suggestion that this be made in the form of a brief, which it said would receive careful consideration.

Mr. Weber in turn appointed a five-man board of O.P.M.A. to make a further study of the details of the FTC decision. Other members of the committee are: O. J. Shaw, Nebraska; R. J. Rogers, Indiana; Harry B. Hilts, New York; G. A. Primm, Illinois, and Mr. Thatcher, N.C.I.P.A. president.

*Washington—By Herbert Yocom*

## Diplomatic Support to U. S. Oil Interest Abroad Gains Headway

WASHINGTON—In exchange of correspondence between PAW Ickes and Secretary of State Byrnes provides the most encouraging evidence yet of a very definite determination on the part of the State Department to lend all possible diplomatic support to American oil interests operating abroad.

Mr. Yocom

Just made public, the exchange was initiated back in September by Mr. Ickes, who wrote Mr. Byrnes to urge that the State Department continue during peace the war-time practice of having petroleum attaches on duty at key spots around the globe. "I feel confident," said Mr. Ickes, "that this proposed course of action would further the public interest and would, at the same time, prove highly effective as a means of supporting and advancing the United States petroleum industry abroad."

Back came Mr. Byrnes with the reply that not only did State plan to keep the petroleum officers now functioning in 13 locations, but intended sending oil representatives to at least five other centers, naming Rio, Buenos Aires, Mexico City, Budapest and Batavia. Then, most important of all, he added this comment, which can be considered as the first official statement of the future foreign petroleum objectives of the U. S.:

"In developing plans on a global basis for the assignment of petroleum officers in foreign nations or areas, consideration has been given to such factors as (1) importance of each country or area as a center of petroleum resources or trade, (2) need for moderation of local laws or regulations restricting American nationals from access on equal terms to the petroleum trade and raw materials of such country or area, (3) restoration of petroleum properties to American nationals in complete good order and with appropriate compensation for loss or damage incident to military operations, (4) possibility of assisting American interests to obtain new concession opportunities abroad, (5) orderly disposal of U. S. surplus and Lend Lease petroleum facilities and equipment, (6) revitalization of local petroleum industry within each friendly foreign nation as means of rehabilitating any war disrupted internal economy, (7) operations and technological developments of foreign oil industry, and (8) trends in oil policies of foreign governments."

° ° °

FOREIGN DEPT.—Arabian-American Oil Co. has completed acquisition of rights-of-way across Trans-Jordan and Palestine to Haifa for its proposed pipeline from Saudi Arabia to the Mediterranean; is now about to commence negotiations for other possible routes to the sea . . . Now that the Russians apparently have settled the controversy in northern Iran by moving in and taking over, diplomatic officials here would not be surprised if the Tehran government soon indicated a desire to resume conversations with American companies, including Standard-Vacuum and Sinclair, over concessions rights in the south . . . There are signs that the Swedes are backing off a bit from the idea of making petroleum marketing a government monopoly or taking other steps designed to freeze out U. S. and British marketers . . . You can look for a real fight if, as many think he will, Secretary Ickes tries to claim Interior Department jurisdiction over the International Petroleum Commission provided for in the Anglo-American Oil Treaty, because State Department never will concede that it is any of Interior's business, which it isn't!

° ° °

DOMESTIC FRONT—Senate Petroleum Resources (O'Mahoney) Committee, which announced plans to hear the independents in January, actually may not get underway again until early February . . . Rep. Clarence F. Lea, of Calif., is hopeful of being able to persuade the House Rules Committee, soon after Congress reconvenes Jan. 14, to O.K. his resolution providing for a full-dress transportation inquiry. Past efforts to pry loose the resolution have been unavailing, however, and there's no telling what success Mr. Lea may have when he goes back to the committee . . . Because information reaching it "indicates" that some operators are charging over ceiling prices, OPA is starting a nation-wide survey of all automobile parking lots in metropolitan areas to get the true facts.

*Midwest—By Earl Lamm*

## Texas Natural Gas Conservation Move Urged in NPN a Year Ago

CHICAGO — Natural gas industry in Texas is washing its dirty linen.

It is a healthy move toward retention of conservation by state authorities. The Texas Engineering Committee, the Railroad Commission, and Col. E. O. Thompson, who announced details (NPN 12/26, p. 36), are to be congratulated. The action was strongly urged in this column a year ago (NPN 12/27/44, p. 15). Leading up to it was previous comment here on Aug. 18, 1944, on the Memphis Natural Gas Co. case, which quite clearly indicated Federal Power Commission's ambition to take over control, not only of natural gas but of oil too. Natural gas was to be merely the entering wedge. This contention was later publicly denied by FPC, but the industry is still skeptical.

Mr. Lamm

Remedying the daily waste of 1,426,000,000 cu. ft. of casinghead gas, now that it has been inventoried and reported upon in 177 fields in Texas, is not going to be a simple matter. Oil and gas men who remember the bitter battles to initiate original oil field conservation measures in Oklahoma some 20 or 30 years ago will not be discouraged—with FPC at their throats. Killing the wasteful oil field flambeau is a worthwhile objective. It is hoped that the work will be pushed and that FPC will have the good sense to let industry and state conservation authorities do it. FPC can rightfully credit itself with wielding a threatening big stick that brought the matter to a head.

As pointed out here last year, hushhushing the shortcomings of industry won't cure its ills. Other states not already proceeding should follow the example of Texas and wash industry linen wherever it is dirty. It can then be hung in the public square by able public relations. A clean industry has something to justifiably brag about. There will be no lack of interest. If that interest is not created favorably by industry and state conservation authorities, one or more federal agencies are certain to do it unfavorably by dragging the dirty linen from the closet.

° ° °

From where we sit, it appears that competition between federal agencies for permanent control of oil and gas is not lessening. It is increasing because of jealousies of top agency heads in Washington and their impending reorganization by President Truman. Mr. Ickes' bid for control was laid upon the Congressional table a few days ago. Federal Power Commission is resting because of a new chief. Federal Trade Commission activities in oil marketing are well known. So are those of OPA.

There is some cause for worry over the shortage of fuel oils, but that is no real reason for PAW to extend its life and reinstitute controls. The trouble is OPA price ceilings and there is some promise of adjustment at meeting of

industry and OPA here in Chicago, Jan. 4.

The industry knows where the civilian shortages of fuel oils are and if freed of strangling regulations can take care of them. Likewise, the military needs. Apparently, the military has lapsed into earlier habits of laxity or failure to make known its needs far enough in advance for industry to meet them promptly. It can be emphasized that there are now no shortages of crude oil, refinery capacity, transportation or manpower. There is some difficulty about keeping labor on the job, but that can and is being adjusted. Bureaucracy is merely seizing upon transitory reconversion situation in an effort to pump new life into agency existence. If oil men do not continuously oppose them, as seen from here, they are not likely to pass out next June when the War Powers Acts authorizing them are scheduled to expire.

* * *

One section or group of industry committees who receive little or no general recognition for their very excellent work are the numerous small oil field engineering committees. They are composed of local engineers and field men representing various companies operating wells in a particular field. They constantly watch and study the intimate pecularities of the field and either act individually or make recommendations to state conservation authorities for improvements. They are the very foundation of creditable conservation.

**PIPELINES** NPN Writers at Three Vital Points Discuss the Industry's problems

Due to the illness of Frank P. S. Glassey, the weekly Atlantic Coast column was not available for this issue of NPN.

## National Rfg.-Mid-West Announce Affiliation

NPN News Bureau

CLEVELAND — Mid-West Refineries, Inc., Grand Rapids, Mich., became affiliated with National Refining Co. here on Jan. 2, 1946.

The sale of National's oil business and oil properties to William Gilroy and Associates was approved by the Board of Directors of National Refining Co. on Nov. 26. At that time it was announced that the refining and marketing business would be carried on by the new owners under the name of "The National Refining Co." and that the old National Refining organization expected to expand their activities in the textile and other fields under a new corporate name.

The organization of the William Whitman Co., with Albert A. List as president, and William Whitman, Jr., of Boston, as board chairman and the affiliation of Mid-West and National indicates that these plans are being carried out.

Mr. List in January, 1944, with associates, acquired control of National Refining, along with several other Cleveland properties and several woolen mills in the East and South and will continue to operate these properties.

Oil properties still held by National were transferred as of Dec. 31 to Wallace Gilroy and associates, who will continue the oil business. Mr. Gilroy, formerly president of Imperial Refining Co., Grand Rapids, Mich., will head The National Refining Co. He became chairman of the executive committee of Mid-West Refineries, Inc., after Imperial merged with Mid-West.

The National Refining Co. has its general sales, administrative, advertising and accounting offices in Cleveland. Its 9300 b/d refinery in Findlay, Ohio, produces all types of gasoline, motor oils, fuel oil and lubricants. These products under the brand names of En-Ar-Co, White Rose and Nareco, are distributed through jobbers and independent dealers.

Mid-West Refineries operates refineries at Grandville (4500 b/d) and Alma (3500 b/d) Mich., with general sales, advertising and administrative offices located in Grand Rapids. The company was established in 1933, and distributes its products under the Mid-West brand through independent jobbers and dealers and Mid-West service stations.

In announcing the affiliation of National and Mid-West, the companies said that while all functions and policies of the two companies will be correlated, each company will maintain their present status of separate operation.

Mid-West has announced that plans are under way by the new organization to add a modern catalytic cracking plant to present operations.

## J. L. Latimer Elected President Of Two Magnolia Companies

*Special to NPN*

DALLAS — J. L. Latimer of Dallas has been elected president of Magnolia Petroleum Co. and Magnolia Pipe Line Co., effective Jan. 1.

Mr. Latimer, who started when he was 18 with Magnolia as a loading rack helper, succeeds D. A. Little, who retired after 32 years with the companies in order to regain his health.

Mr. Latimer was born May 11, 1897 in Olean, N. Y. He has been a vice president of the companies since 1938 and for the last two and a half years has been active in the executive management of both companies. The two Magnolia firms are subsidiaries of Socony Vacuum Oil Corp.

## Western Oil and Gas Assn. Re-Elects Lloyd 5th Time

NPN News Bureau

LOS ANGELES — Ralph B. Lloyd, president of Lloyd Corporation, Ltd., was re-elected president of the Western Oil and Gas Assn. for his fifth consecutive term at a recent meeting of the association. Elected as vice presidents were: William Reinhardt, vice president, Union Pacific Railroad Co., and H. D. Collier, chairman of the board, Standard Oil Co. of California.

John B. Sutherland, Division Manager, Ohio Oil Co., was named treasurer. Other officers of the association re-elected are: Don E. Gilman, executive vice president; David S. Kilhour, secretary; George F. Prussing, technical secretary, and John M. Peirce, economist.

## H. G. Vesper Succeeds Halloran As California Research Head

NPN News Bureau

SAN FRANCISCO—Howard G. Vesper has been elected president of California Research Corp., Standard of California's research subsidiary, effective Jan. 1.

Mr. Vesper succeeds Ralph A. Halloran who is retiring after 26 years spent as head of Standard's research activities.

Three other California Research management shifts also were announced. Alois Kremser leaves as vice president to become R. G. Follis' personal advisor on research matters and two men move into vice presidencies. L. P. Elliott, formerly assistant director of Richmond laboratories, takes over Mr. Kremser's duties, while A. L. Lyman, who was in charge at Richmond, becomes director of all laboratories.

Mr. Vesper, who went to work with Standard following his graduation from California Institute of Technology, recently has been manager of the gasoline and fuel oil division of Standard's marketing department.

## Move Started for Indiana to Join Compact Commission

*Special to NPN*

INDIANAPOLIS, Ind. — Dr. Charles F. Deiss, director of the division of geology of Indiana's Department of Conservation has started a movement to have Indiana join the Interstate Oil Compact Commission. Participation as a member can be authorized only by the Indiana General Assembly. In 1943 a similar proposal failed to pass. Legislators were opposed to all extra expense.

Dr. Deiss recently advised Indiana officials that through membership with states now producing 80% of the national oil production, Indiana would benefit from the conservation studies being made by the interstate group. Under present conditions representatives of Indiana can attend the quarterly meetings of the compact commission only as observers.

## Davies Hopeful for Continuation of Mutual Understanding of Oil Industry, Government

Deputy PAW Ralph K. Davies expresses strong faith that both the oil industry and government will continue mutual understanding, good faith and goodwill in 1946. But this result will not come automatically, says Mr. Davies, who gives this message, through NPN, to the industry:

The most striking oil phenomenon of the war years has been the development of goodwill and mutual understanding both within the industry and between the industry and the government. I hope and trust that this goodwill and mutual understanding may continue. The need for government direction of industry has passed, but the need for harmonious relationships has not.

I see no reason why we should discard the mutual respect, the understanding, the liking for one another that we have gained, or discontinue a relationship that has made possible so great a gain. Neither can I see why the combined thought of those who have the good of the industry and the public at heart, in both industry and government, should not be brought to bear on common problems.

Through what media the contacts should be maintained and the common thought brought to bear is something to be worked out. The mechanism by which the industry provides for the free interchange of views among its diverse elements and for making its common experience and practical judgment available to the government, or by which the Government coordinates its many activities affecting oil and provides for consultation and cooperation with the industry—these are of less importance than the spirit of fairness, mutual respect, and devotion to the national welfare that both government and industry must maintain if whatever mechanisms may be created are to function successfully.

I have faith enough in both industry and government to believe that mutual understanding, good faith, and good will can continue. But I am sure that such a result will not come about automatically—without intelligent effort and without statesmanlike vision. Both government and industry have here an unparalleled opportunity and a great challenge.

## Tank Truckers Are Granted Temporary Permit Extensions

NPN News Bureau

WASHINGTON—Following the signing of Second War Powers Extension Act by President Truman, the Interstate Commerce Commission has notified tank truckers by telegram that their temporary authorities have been extended, as follows:

(1) Carriers seeking continuation of temporary authority on existing operation, on which protests had been registered with ICC were granted extension until March 1.

(2) Carriers seeking extension on which no protests were registered, may continue operating under temporary authority until June 30.

ICC reserves the right to review the authorities renewed for additional 60 days and either extend or revoke them by March 1. All authorities good until June 30 may be extended for an additional 180 days upon application, or until Dec. 31, 1946.

As far as applications for permanent authority are concerned, ICC expects to conclude hearings by June 30 and render its decisions by Dec. 31.

## *Travel Boom Seen By A.A.A. President*

Regardless of labor differences in the automobile industry, the average person intends to travel further, spend more money and take more frequent vacations in the future. These people expect to use old cars for vacation purposes rather than await production of new models.

This is the prediction of H. J. Brunnier, president of the American Automobile Assn., and is based on surveys and a study of plans of motorists by A.A.A. These prophecies add up big business for the oil industry, particularly in the fields of lubrication and T.B.A. business in keeping the old cars in position to do their touring job while the owners await production of the new models.

Here is Mr. Brunnier's forecast for the travel prospects for 1946:

Reports from all over the country indicates that states, cities and resort areas are readying themselves not only for a big increase in travel in 1946 but also for continued expansion throughout the next decade.

Throughout the war years, the A.A.A. has been predicting that the return to normal conditions—particularly the lifting of gasoline rationing—would mark the beginning of a new era in touring—an era in which we could confidently look forward to surpassing the $5,000,000,000 volume that tourist business represented before Pearl Harbor.

These prophecies on travel are based solidly on a study of the touring plans of the motorist. A survey made just before the end of the war by the A.A.A. through a sampling of the 1,400,000 members in affiliated clubs all over the country disclosed significant facts.

The poll returns show clearly that the average person intends to travel farther afield, to spend more money, and to take more time on more frequent vacations. Of the answers received, 84.5% stated a preference for the private passenger car as the best mode of transportation for vacations. The other 15.5% were divided in favor of four other means of travel.

The eagerness of Americans to take to the road again, to see new places and to relax once more after four long years of war, is apparent in another of the survey findings. Of those polled, 61% said that they would use their old cars for vacation purposes rather than await the production of new models. This is a significant indication of the trend we may expect in coming months, irrespective of whether or not labor differences in the automobile industry are resolved speedily. Lagging production of cars will have more effect upon the long-range view of travel than it will on the immediate future.

Of first importance to travel in 1946 is the speed with which cities and resort communities reconvert their facilities for reception of visitors. This means repair of roads and highways, especially in urban areas; the refurbishing of overnight accommodations, and the re-establishment of sufficient service facilities to care for the needs of the tourist both en route and at his vacation objectives.

## U.S. 'Gas,' Tire Tax Receipts Increase in November

NPN News Bureau

WASHINGTON—Federal gasoline taxes rose more than $5,770,000 in November over collections for the corresponding month of previous year, reaching a total of $38,887,065, Internal Revenue Bureau has announced. An increase also was shown in taxes on tires and inner tubes, which rose about $2,650,000 to $8,375,182.55.

Declines were reported, however, in receipts on lubricating oil, down more than $730,000 to a November level of $6,020,000.53, and on transportation of oil by pipelineo, which fell about $46,700 to $1,281,887.28.

U. S. tax receipts on these and other oil-related items were listed by IRB, as follows:

IRB COMPARATIVE STATEMENT OF FEDERAL INTERNAL REVENUE COLLECTIONS

| Source of Revenue | Nov. 1945 | Nov. 1944 |
|---|---|---|
| Gasoline | $38,887,065.76 | $33,114,838.30 |
| Tires & inner tubes, including floor taxes | 8,375,182.55 | 5,715,403.42 |
| Lubricating oils | 6,020,000.53 | 6,750,243.85 |
| Transportation of oil by pipe line | 1,281,887.28 | 1,328,638.38 |
| Gas, oil and electric appliances | 1,601,429.04 | 747,700.44 |
| Automobile trucks | 2,057,353.42 | 1,599,138.02 |
| Automobiles and motorcycles | 201,296.78 | 318,116.76 |
| Use of motor vehicles | 421,574.62 | 571,063.44 |

# Oil Workers Turn Away from National CIO Leaders As They Discuss More Reasonable Wage Increases

MEMBERS and local officers of the CIO Oil Workers unions appear to be showing the good sense of turning away from the leadership of their national officers.

The strike settlement with Sinclair on an 18% wage increase, while subject to question, is far more to the benefit of the people of the United States and to employes in other lines, than the 30% demands of the CIO unions. Reports are that in negotiations now under way with the other struck oil companies, the unions seem to have accepted a 15% to 18% increase while arguing about other points in the terms of employment.

The wild and radical and utterly unAmerican character of the CIO national leadership is being shown in many ways. Not the least of such showings are the strikes that were called in the oil industry after a long history of high wages to employes, a history with most companies dating back to their origin, and a history unmarred by strikes. None but fanatical leadership, or leadership interested in strife and power more than the welfare of the employes, would have precipitated strikes under the circumstances.

## Tries Forceful Arbitration

True the national CIO officers seem to have had an understanding with the Truman administration that their 30% demands would be supported by the administration as they were in the so-called "conciliation" sessions. The story of those sessions in which the administration's aides tried to put over the 30% demand and in which these aides broke all rules of "conciliation" work by trying to force the arbitration of the difference between a compromise offer and the demands, now has greater significance for all employers and for all citizens in the light of more recent information.

Here in Cleveland the other day the president of the CIO's auto workers union frankly stated that he had a promise from the late Roosevelt, speaking as president of the U. S., that he, Roosevelt, would see that the take-home pay of the war was continued after peace in return for the union's promise not to strike during the war.

## Describes Deal as 'Greatest Bribe in History'

"The greatest bribe in the history of the United States," is how the Independent Democratic Cleveland PLAIN DEALER describes this deal. And that paper adds, "Thomas (the CIO Auto Workers president) is not only unashamed that labor had to be bribed to stay on the job during the war but he is resentful that President Truman has not fulfilled the promise he claims Roosevelt made."

However faulty Truman's efforts may be to try and carry out any such "bribe" the record that Truman is writing from day to day rather plainly shows that he probably is doing the best he can in support of all labor demands.

Even though a president of the United States is willing to make such a bribing deal against the interests of the people, that still does not excuse the labor leaders for their part of it. That these leaders made such a deal in the country's greatest crisis is good reason why they are not fit to lead any Americans.

## Lack of Truth Seems Prevalent

Studying further the character and conduct of these union CIO leaders, one is impressed with their failure to stay anywhere near the truth in most of their statements. They make one mis-statement after another and of such a wild nature that one imagines they think the general public are fools. In this connection one notes that one of the counter demands of General Motors to the unions is a "guarantee against personal attacks, false accusation and vilification of management" and "that the international union accept full responsibility for publication of such material."

At no time, it may well be noted, has Truman or any member of his following voiced criticism of such wild talk and vilification by the union leaders.

In further sizing up these union leaders and their qualifications to lead honest American citizens, is the zeal and fervor with which these leaders break contracts with employers—also without criticism from Truman—and post pickets who by force take physical possession of a struck premises even to excluding necessary maintenance crews and officials of the company. At Detroit the other day these leaders caused a strike committee to adopt resolutions condemning General Motors for trying to get office and maintenance people through their picket lines charging that such efforts were to provoke disturbances which would permit appeals to the courts for injunctions.

## Denies Rights of American Citizens

What kind of leadership is this that says to American citizens they may not enter lawfully upon streets and property without being subject to personal attack and, if attacked, then these citizens be held to be the aggressors in their attempts at lawful entry and therefore be responsible for the sluggings they received?

While some judges, like Truman et al and other public officials, are deliberately ducking and winking at such violations of law by the labor unions, there seems to be a stalwart governor in Connecticut, who believes in enforcing the laws even against lawless strikers for he recently served notice that mass picketing with intimidation and threats and the use of force is unlawful and he would see to it that such practices were stopped.

Then what of these CIO leaders who are violently insisting that union demands for more pay be granted so long as a com-

**READERS' comments and opinions will be much appreciated by Warren C. Platt, NPN's Editor and Publisher, Penton Building, Cleveland 13, Ohio.**

pany has any or may have any profits, and regardless of the customer's and stockholder's interest in those profits?

Are these the demands of men interested in continuing the American system of government and business or are they trying to install another form of government in this country?

Is the insistence of these CIO leaders that they and they alone shall determine the amount of wage increases so long as there are any profits, an attempt to usurp the responsibilities of management and of the owners?

Chairman Sloan of General Motors in announcing the refusal of his company to agree to submitting GM books for government and union inspection so that government and union can determine the extent of profits if any and determine the wage increase to be paid, says that "America is at the crossroads" of American freedom and it is faced with the transferring "to some governmental bureaucracy or agency, or to a union, the responsibility of management that has been the very keystone of American business."

### *Past Profits No Guide to Future*

As past profits are generally no certain guide to future profits the contention of these CIO leaders means that they would have to know all of the future plans, down to the last detail, for a business, what executives the business might be going to replace the coming year or two, what new products the company would make, where it would sell those products, how the company would finance itself perhaps to steer around some possible financial holes—all this these leaders would open to the unions and to the public and to every one's competitors. But worse than this, the decision as to the expenditure of these future profits, if any, would be made in effect by the union leaders and the government appointive bureaucrats.

And if the profits did not materialize whose money would be lost? Certainly one does not find in what these CIO men or President Truman have said, anything about either the unions or the government compensating the stockholders for losses. Perhaps the CIO leaders and Truman appreciate that any such absorption of losses would be an open admission of their intent to socialize business.

### *Time to Pause and Think*

In view of the record to date it is well for not only the members of the CIO C.I Workers but for all Americans to pause on the threshold of this New Year and consider just what are these CIO leaders? One may well ask, are not these leaders men who are seeking a completely different America from that we have had so far, one patterned after Soviet Russia's original pattern? Yes even one patterned after that of the late Hitler?

In considering these momentous questions neither the rank and file members of these unions, nor the rest of the American people should permit themselves to be diverted from these fundamental questions by any bullying bellows of these CIO labor leaders, nor dissuaded by any double talk by those at Washington who appear to be trying to carry out "the greatest bribe in the history of the United States" for their own continuation in public office.

# *May the Paths Lead to Peace*

"Vast, isn't it? But how Peaceful!"

The above is how the near horizon looks to a returning soldier, and it also is how it should look to every oil man.

Beyond the horizon our possibilities are vast, greater than ever. And beyond that line, between the present and the future, is a peace that insures the vastness of the oil industry's possibilities.

The above sketch and lines are taken from the holiday greeting card of an oil man and soldier who saw service in the European theater. He is Lt. Col. Cornelius B. Savage, oil producer of Fort Worth, Tex., who, overseas in this last war as well as in the previous one, was in Army Engineers. In this last war his engineering was done for the "POL" Section, laying out and helping to construct the famous U. S. Military Pipe Lines that stretched across France and finally over the Rhine.

The vastness and peacefulness of the future appeals particularly to the returning millions of soldiers and sailors because they, being young, will make the paths across that vastness where, let us hope, they will always enjoy peace.

The oil industry emerges from the war unscathed, with practically no reconverting of plant to do with nearly all government controls taken off. The only control that is being retained, the industry is proving, should be taken off at once. That is the control of price because already refinery market prices on gasoline and some lubes are weakening from the pressure of increasing surplus products on the markets.

With a great sufficiency of raw material and an ever increasing supply of returning manpower, the industry is also being given the benefit of immediately enlarging markets. The great automotive industry is moving with all its resources to get into the greatest automobile and truck and farm tractor and Diesel engine production in history. The rapidity of the re-creation of this automotive market for the oil industry may be slowed down by strikes, but the people of these United States will never let themselves be deprived for long of the motor transportation which they so vitally need for their own living and welfare.

### *Aviation Promises Even Bigger Market*

The world of aviation is also striving to create a far bigger market for petroleum products than ever existed prior to the war and even than was anticipated a few months ago.

The heating oil and other oil burning appliance manufacturers are also fighting for material with which to make the winter of 1946-47 the greatest ever in oil heating.

Then, before us is every manufacturer of every kind of thing for industry and for the home, fighting for immediate resumption of his own business, a resumption that will call for increasing products of petroleum.

So every oil man, no matter what his job or his business, can well stand with the two GIs that Colonel Savage has sketched at the horizon line and say with them, "Vast, isn't it?"

And with them also we all can join in their hope that the paths they will make across this vastness of tomorrow will all lead to peace.

# The Petroleum Industry Didn't Keep the Public Waiting

JUST A FEW DAYS after better grades of gasoline became available to the public *anywhere in the country,* they were available at service stations *around the corner from everywhere.*

Behind the quick efficiency of this public service—which, in America, we take for granted—lies the petroleum industry's ability to perform the daily miracle of *nation-wide distribution.*

Large fleets of motor trucks—operating with a precision based on long years of experience—help make the miracle routine. Here, as in so many other industries in which dependable truck transportation is essential to high standards of public service, White Super Power Trucks have earned a position of marked preference.

During the wartime period of truck shortages and extra demands on those in service, White owners in all fields benefited from Super Power's extra performance, dependability and low cost maintenance over tremendously high mileages...aided, in many cases, by the White Plan of Personalized Service which stressed the necessity for correct, frequent lubrication and helped educate thousands of truck owners to adopt scientific lubrication programs as an aid not only to conservation of motor equipment but also to more dependable performance and greater economy.

**THE WHITE MOTOR COMPANY • Cleveland**

White

*FOR MORE THAN 45 YEARS THE GREATEST NAME IN TRUCKS*

## Tanker Tonnage Surplus Looms On Basis of Present Fleet

Though the world tanker tonnage presently represents a surplus over pre-war requirements, the present 22,000,000 dwt. fleet represents a possible paradox of too little and too much.

M. G. Gamble, general manager, Marine Department, Standard Oil Co. (New Jersey), points out that utilization of the entire tanker fleet would result in a surplus while failure to use American government-owned tonnage, the world would be short about 4,000,000 dwt. in meeting postwar requirements.

Mr. Gamble's outlook follows:

It is estimated that world tanker tonnage presently afloat approximates 22,000,000 dwt., equivalent in carrying capacity to about 26,000,000 dwt. of pre-war tankers, which represents a surplus of about 9,000,000 dwt. over pre-war requirements. These figures of tonnage availability compare with the approximate total of 17,000,000 dwt. which took care of world requirements in the pre-war period. Consequently, we are faced with a very large surplus of tanker tonnage based on pre-war needs.

### U. S. Owns 10,000,000 Dwt.

Of the present total world tanker tonnage, the U. S. Government owns approximately 10,000,000 dwt., equivalent to about 13,000,000 dwt. of pre-war tonnage and it is apparent that without the use of American government-owned tonnage the world is short about 4,000,000 dwt. Another factor materially affecting tonnage availability will be the retirement of a considerable number of obsolete tankers.

In our opinion the major postwar tanker problem is to find a suitable method whereby the American Government can dispose of sufficient tankers to private interests to take care of commercial needs. At the present time Congress is discussing and framing a bill covering disposal of Maritime Commission tonnage. The price structure contained in this bill will of course be the determining factor as to whether private industry purchases tankers from the Government or embarks on building programs to cover their transportation needs.

## Automotive Production Picture for '46 Seen Good, Barring Continued Labor Difficulties

Both Alvan Macauley, president of the Automobile Manufacturers Assn., and Richard T. Purdy, manager of the motor truck division of that association, paint bright pictures for the year 1946 in these bread and butter products of the oil industry. But they both base their predictions on the extent to which labor troubles hold back production.

### Views Truck Outlook

Mr. Purdy, A. M. A.'s motor truck division manager says:

"The automotive industry enters the new year planning a record production of at least 1,000,000 motor trucks during 1946, or 40% more than the average production for the five-year period from 1935 to 1939.

"Reconversion of facilities from wartime to peacetime operations is practically complete in the motor truck manufacturing plants, and record production would be rolling off the assembly lines now if it were not for strikes and shortages of materials which in most cases have been caused by labor trouble. Truck makers in general emerged from the war with expanded production facilities and, in addition, many of them are now completing programs to increase capacity from 25 to as much as 200%.

"The long-term demand for motor trucks never was better. More than half the trucks in use today are more than nine years old. Most of the average production of 82,400 commercial trucks during the war years of 1942-44 was made up of heavy duty trucks and comparatively few light and medium-sized trucks were retired to the scrap heaps.

"At least 2,000,000 trucks or about half of the total number licensed in this country, have been kept operating only by extraordinary expenditures for repairs and maintenance, and will be replaced by new vehicles just as soon as they are available. On the most conservative basis, a production of at least 1,000,000 trucks annually for four years will be necessary to meet the unusual domestic and export requirements and to replace the 'over-age' trucks now in use.

"Most trucks now being manufactured are little changed in appearance from pre-war models. Major mechanical changes are probably a year or two away. Engineering staffs which have been busy designing wartime vehicles and weapons are just beginning work on designs to incorporate developments tried out in battle or military operations. Automatic or power control of gear shifting, improvements in axle drives, increased engine power, better bearings and valves, more use of aluminum and magnesium to lower truck weights and increase pay loads, power steering, better brakes, and improvements in cabs are some of the possibilities.

"The truck industry, barring prolonged labor tie-ups and serious material shortages, is ready to do its part to turn out a record number of trucks so that there will be no impairment in the vital services provided by trucks in peacetime, just as there was no impairment in those services during the war."

### Can Outstrip '39 Production

President Alvan Macauley of A. M. A., says that the automotive industry by mid-year, 1946, can produce cars, trucks and trailers at twice the average monthly rate achieved in 1939, provided present deterrents to production can be overcome. He adds:

"If present obstacles are overcome, efficient production in 1946 can mean millions of cars for the public, expanding employment for labor at good wages, low prices for the consumer, and stimulation of the economy of the entire country.

"No one can minimize the effect that full production in the automotive industry can have. One new car is like a pebble tossed in a pool in its effect on the nation's economy. This car needs servicing, it needs gasoline, oil and lubricants. It affects in increasing proportion all of the allied industries.

"Much can be done in 1946. We can have millions of new cars at low prices, expanding employment at good wages for workers, and stimulation of the economy of the entire country. But it is all contingent upon production. And—as has been shown—only the solution of the problems we are confronted with today and which are paralyzing our efforts can guarantee the cars, jobs and way of life we seek."

## Okays Lease Extension to June, '46, on Trucks, Trailers

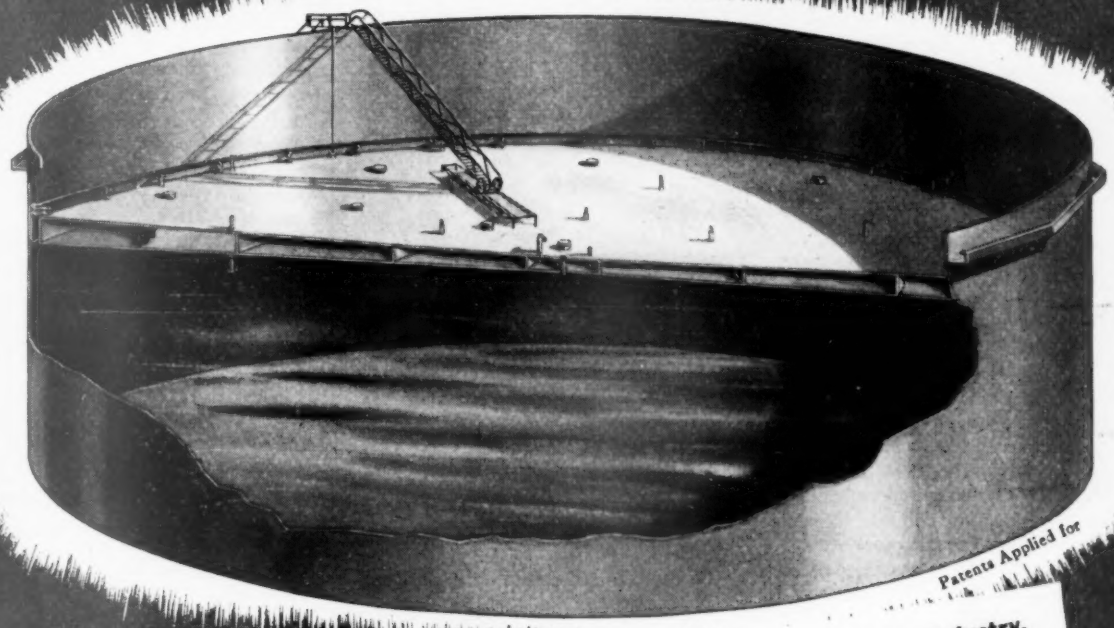
NPN News Bureau

WASHINGTON—RFC has agreed to extend until June 30, 1946, the period in which petroleum transporters can operate DPC-owned equipment (full trailers, semi-trailers, and tractors) under rental terms of the original lease. Affected by the re-leasing action are 186 trucks and truck-tractors and full tank trailers valued at about $1,670,936.60, now leased and operated by about 13 carriers in 11 states (Arkansas, Illinois, Texas, Colorado, Louisiana, Florida, South Dakota, Iowa, Pennsylvania, Indiana, and Kentucky).

Leases, which originally were to expire 30 days after signing of unconditional surrender of Japan, had been extended to Dec. 31. If DPC had not acted when it did, said C. Austin Sutherland, secretary of National Tank Truck Carriers, Inc., "at least 98 of the 153 trailers now on the road would have been laid up on Jan. 1."

Carriers desiring to continue operating their DPC-owned equipment should apply to their regional RFC office at once, RFC said.

# the HORTON FLOATING ROOF




**A double-deck roof designed and built to do a better job for the petroleum industry.**

● Double-deck construction insulates the liquid in the tank and eliminates practically all boiling. This extends the range of products that can be stored in tanks with floating roofs.

Bottom of deck is sloped up slightly toward center facilitating the venting of all air from beneath the deck each time roof rests on its supports and is floated again. Elimination of air-vapor mixture under roof prevents breathing losses.

Roof is practically unsinkable and extremely stable.

Deck drains rapidly to screened opening at center.

Open sump draining rain water into tank, pipe drain or flexible hose optional. No siphon necessary with open sump.

Normally, vent at center of deck is closed when the roof is floating. Entrained vapors collect under the deck—without reducing the stability of roof—until they recondense.

When used on corrosive oils, the center vent may be left open and bottom of deck kept in contact with liquid at all times when roof is floating. You may want to operate the roof with the vent closed, even on sour oils as the entrained vapors collecting under the roof do not contain enough air to cause rapid deterioration.

Top of the deck is smooth and free of obstructions.

Space between deck and tank shell closed by effective sealing ring which forms a long sliding contact with tank shell. Secondary seals supplied when product stored requires added protection.

Installed complete with adjustable deck supports, gauge hatch, bleeder vent, drain, emergency drain, and manholes.

Embodies the engineering experience and skill acquired by Chicago Bridge & Iron Company in designing, fabricating and erecting floating roofs since 1923.

## CHICAGO BRIDGE & IRON COMPANY

ATLANTA ○ BIRMINGHAM ○ CHICAGO ○ CLEVELAND ○ HAVANA ○ HOUSTON
LOS ANGELES ○ NEW YORK ○ PHILADELPHIA ○ SAN FRANCISCO ○ TULSA ○ WASHINGTON

*Plants in BIRMINGHAM, CHICAGO and GREENVILLE, PENNSYLVANIA*

## Oil Truck Transport Outlook For 1946 Seen Optimistic

The coming year brings with it a spirit of optimism for petroleum motor transport fleet operators, according to W. H. Esser, Automotive Division, Shell Oil Co. and past president of Petroleum Motor Transport Assn. of Oklahoma. Viewing the overall outlook for oil truck fleets, Mr. Esser says:

For the past four years, the petroleum motor transport fleets were called upon to do an almost impossible job. With new equipment practically extinct, with inadequate mechanical labor available, with substitute and inferior replacement parts, with inexperienced drivers, with tires that bordered on rags, and with under-maintained highways and streets; an outstanding job was done to keep vital crude oil moving to our refineries and finished products to the armed forces and to essential civilian industry.

For 1946 we are optimistic. We can see new equipment with engineering refinements developed and tested in military usage. We anticipate the early return from the services of our experienced mechanics and drivers. Tires should have longer life. Highway repair, modernization and new construction should ease the burden of repairs to motor vehicles.

We hope that in 1946 we will see the transition from a fleet of overworked vehicles to a fleet of new modern vehicles, permitting a return of efficient and low cost operations.

## Culberson Says He Will Not Oppose New Gas Pipelines

*Special to NPN*

AUSTIN, Tex.—Railroad Commission Chairman Olin Culberson, who has been the commission's main objector to exporting Texas natural gas, says that he will not oppose applications for new gas pipelines from Texas to California.

He said he understood the two companies which have applications before the California Railroad Commission will take West Texas flare gas and that he is doubtful that the Texas commission will have anything to say in the matter. Mr. Culberson said he is still "strongly opposed to any dissipation of our straight natural gas reservoirs."

## Maritime Commission to Open Bids for 17 Tank Barges

NPN News Bureau

WASHINGTON — U. S. Maritime Commission last week offered for public bidding 17 converted steel tank barges suitable for crude or residual. Bids will be opened and read at commission's Washington office on Jan. 23.

Offered for bidding are:

(1) Ten barges, with capacity of about 13,000 bbls. of residual at 9 foot draft, and with approximate dimensions of 230 ft. x 45 ft. x 11 ft., currently located at Pearlington, Miss. Government designations of these barges are DPC 8 Inland, DPC 9 Inland, and DPC 20, 31, 33, 52, 62, 63 and 65, all Inland.

(2) Five barges with about 6,000 bbls. capacity of residual at 9' draft, approximate dimensions of 132 ft. x 35 ft. x 10 ft., and the following government designations: DPC 201 C TC, DPC 202 C TC, DPC 204 C TC, DPC 206 C TC, and DPC 209 C TC, all located at Madisonville, La.

(3) One barge with about 7300 bbls. capacity of residual at 8-foot draft, approximate dimensions of 130 ft. x 50 ft. x 9 ft., and government designation DPC 53 R TC, also located at Madisonville.

(4) One barge with residual capacity of about 13,000 bbls. at 9-foot draft, approximate dimensions of 130 ft. x 50 ft x 9 ft., and government designation DPC 455-X, located at Logtown, Miss.

Application for inspection of these barges should be addressed to W. E. McCardle Bank Building, New Orleans, La.

## Completes Gas Pipeline from Carthage to Sterlington, La.

*Special to NPN*

MARSHALL, Tex.—United Gas Pipe Line Co. has completed its 142-mile, 24-inch gas pipeline from the Carthage field to Sterlington, La., and has announced that its entire project in the Carthage area, including gasoline and dehydration plants, should be completed early in 1946.

The company will furnish gas to the Tennessee Gas and Transmission Co. through a connection with the latter's line at Sterlington. United now is proceeding with construction of the gathering system, gasoline and dehydration plants on its holdings. Estimated to cost $7,000,000, it will run the over-all cost to around $14,500,000.

When completed, the line will include 140 miles of gathering system, arranging downwards from 20 inches to six inches. The line from Carthage to Sterlington is designed for capacity of 31,000,000 cubic feet daily with 1000 pounds pressure at the Carthage terminal and discharge pressure of 500 pounds.

## Examiner for ICC to Hear LPG Weight Plea Feb. 1

NPN News Bureau

CHICAGO—Skelly Oil Co.'s plea for lowering of the estimated weight applied to shipments of liquefied petroleum gas from 6.6 lbs. to 4.7 lbs. per gal., has been set for hearing on Feb. 1, 1946, by Interstate Commerce Commission. Hearing will be at the Morrison hotel here before Examiner R. M. Brown.

The Skelly case is one of those not consolidated with Montana-Dakota Utilities Co. case, which was heard in Minneapolis last May.

## Certificate of War Emergency Tankers Extended Six Months

NPN News Bureau

WASHINGTON — Civilian Production Administration has granted War Emergency Tankers, Inc., a six-month extension on its certificate (No. 151) exempting the operating companies from anti-trust prosecution, in order to permit continued operation of WSA-owned tankers until they can be brought back to this country.

Certificate was to have expired Dec. 31, but its renewal in effect gives W.E.T., Inc., an additional lease on life to June 30, 1946. WSA officials had requested the extension, telling CPA that many WSA-owned tankers are still scattered to the four corners of the world, and most cannot be returned to the United States for an additional six months.

## Panhandle Ordered to Show Cause at Jan. 7 Hearing

NPN News Bureau

WASHINGTON — Panhandle Eastern Pipeline Co. has been ordered by Federal Power Commission to show cause at a hearing set for 10 a.m., Jan. 7, 1946:

(1) Why its proposed service of natural gas to Ford Motor Co. at Dearborn, Mich. will not (a) impair its ability to provide adequate service to present customers and (b) violate orders of the commission authorizing the construction and limiting the operation of certain facilities under Section 7 of the Natural Gas Act, and

(2) Why application should not be made under Section 7 of the Natural Gas Act for construction and operation of the pipeline facilities required for interstate transportation of natural gas to Ford Motor Co.

## Okays Tank Truck Waiver Extension

NPN News Bureau

WASHINGTON — Interstate Commerce Commission Division 3 last week granted a one-year extension on safety waivers applying to private interstate tank trucks, stating that it acted ". . . upon a showing by the American Trucking Assn. Inc., and the American Petroleum Institute, that conditions which necessitated the order of Dec. 31, 1943 and its extension, continue to exist and create a need for the further extension of the orders."

The order, which extends effectiveness of all waivers on ICC regulations applying to cargo tanks, four-wheel brake action, outages, and labels until Dec. 31, 1946, unless otherwise ordered by the commission, was issued in exparte No. MC-3, Docket No. 3666, and ex parte No. MC-13.

## TRUCK DRIVERS KNOW

Put an experienced truck driver behind the wheel of a heavy-duty Autocar and he knows he's going places—safely, surely, swiftly, and on time. For Autocar Trucks do more than haul heavy loads. They're built by Autocar *to* haul them. They're superbly engineered and precision-built for heavy-duty work. They're specialists in all heavy-duty fields. Truck drivers know. That's why more and more of them confirm the judgment of cost-wise buyers who turn to Autocar. . . . Buy Autocars—*by* Autocar! Follow the leaders, for they know the way.

# AUTOCAR TRUCKS

***FOR HEAVY DUTY***

MANUFACTURED IN ARDMORE, PENNSYLVANIA
SERVICED BY FACTORY BRANCHES AND DISTRIBUTORS
FROM COAST TO COAST

DETROIT PUBLIC LIBRARY

# Here's how to cut container purchasing *Red tape*

## DISCUSS YOUR CONTAINER PROBLEMS WITH NATIONAL STEEL CONTAINER'S EXECUTIVE-SALES-PERSONNEL

If you like your questions about containers answered directly and authoritatively; if it's service you want—promptly and efficiently carried out, then you should consult with National Steel Container's executive-sales-personnel about your container problems. Modern production methods incorporating the finest-type mechanized production lines speed up manufacturing—assure a consistently high-quality drum with maximum economy for you. The next time a container problem arises, write National Steel Container about it. You will be surprised and pleased at how quickly the problem will be solved by National Steel Container "know-how".

Containers tailor-made in standard and special sizes to meet the specific requirements of Petroleum and Grease industries.

**NATIONAL STEEL CONTAINER CORP.**
6700 South Le Claire Avenue Chicago 38, Illinois

## California Gasoline Taxes Seen Reaching $81,000,000 in 1950

NPN News Bureau

CLEVELAND — In 1950 California can expect a revenue from gasoline taxes of $81,000,000.

That is the anticipation of the Western Oil and Gas Assn., whose optimistic statistics are added this week to the increasing gasoline revenues reported by three other states—Louisiana, South Dakota and Ohio.

The California estimate, based on current trends, indicates tax receipts of $62,500,000 in 1945-46, a possible $71,000,000 in 1946-47, a potential $78,500,000 in 1947-48, and $79,400,000 in 1948-49. Taxable gallonage per registered vehicle has been added to gasoline collections per capita to reach the estimate.

Coming down to the earth of current collections, Louisiana reports $1,867,598 for November, compared with $1,533,641 for the corresponding month of 1944; South Dakota's sales in November were $661,673.81 as compared with $505,892.20 in November, 1944—up 30%; Ohio's October sales were based on 120,243,732 gals., compared with 99,404,566 gals. for October, 1944.

## Auto Clubs Are Sponsoring New High Speed Expressway

NPN News Bureau

CHICAGO—The Chicago Motor Club and the Automobile Club of Michigan, heading the sponsors of the Chicago-Detroit expressway, are working to have the proposed high speed highway the first to actually get under construction under the national program, according to announcement by Charles M. Hayes, president of the Chicago Motor Club.

Standards to govern the design and construction of the expressway will be the accepted minimum values for the national interstate system, Mr. Hayes said and added, "There is little doubt but what the Chicago-Detroit link will be one of the first to be built because its importance has been placed second to only the Boston-Washington road. We hope to reverse this situation."

## American Chemical Society Changes Exposition Date

NPN News Bureau

CHICAGO — The Chicago section, American Chemical Society, has announced that the date of the national chemical exposition has been moved up to Sept. 10 to 14, inclusive, and will be held at the Chicago Coliseum.

Registration of over 21,000 at the last exposition is likely to be exceeded, Dr. H. E. Robinson, chairman of the exposition committee of the Chicago section of the society, said. He pointed out that industrial managers, chemists and engineers are very anxious to see how wartime developments will affect postwar products and productions.

Among those associated with Chairman Robinson is R. F. Marschner, group leader in research department of Standard Oil Co. (Ind.).

## *Standard Oil of Ohio Opens Travel Service Bureau*

**Opening day at the new Sohio Travel Bureau, found a steady stream of would-be travelers on hand to receive travel information. Edward Hamilton, manager, is shown in the left background viewing a road map of the eastern seaboard. The group in the foreground is discussing complete tour service for a ranch vacation in the southwest. (Sohio Photo).**

NPN News Bureau

CLEVELAND — A new trend in oil company service to the public has been inaugurated here with the opening of a Travel Service Bureau by Standard Oil Co. of Ohio.

The new bureau, on the ground floor of the company's headquarters in downtown Cleveland, will conduct a worldwide travel service and handle transportation for rail, air, bus, steamer, hotel and resort reservations and accommodations. It will also arrange tours in any part of the world.

This new service by Sohio is the result of the growth of the company's prewar touring service, which provided route maps and touring information for motorists.

A simple form has been developed by Sohio, which will be available at all of the company's stations on which travelers desiring assistance can state their wants. These forms will be forwarded to the Travel Service Bureau and handled directly from there by mail.

The Bureau is in charge of Edward Hamilton, who for 25 years has been in the travel business and came to Sohio from a Philadelphia travel agency. The bureau will act as authorized representatives for all the well known tour companies and travel organizations, making available their regularly conducted tours to Mexico, Florida, the national parks and other places. It also will help plan inclusive independent trips, modeled to individual preferences, time limits and budgets.

In addtion to securing the services at the travel bureau office and Sohio stations, application for the service may be made by mail, telephone or telegram.

The old Sohio Touring Service, which prior to the war provided highway map and routing service to as many as 6000 to 7000 families a month, will be continued and enlarged as part of the new bureau, Sohio officials said.

"Now that the war is over, and gasoline rationing has been lifted, a pent-up desire of the public to travel will be released," A. A. Stambaugh, Sohio vice president commented. "The Travel Service plans to assist people in every way possible in this urge for touring and travel, which will probably reach its peak as soon as the railroads have overcome the crisis presented by the return of veterans."

# MAN'S HOPE

## *Little, if anything, is impossible*

NOW MAN MASTERS the earth-shaking power in an atom.

Some day then . . . in an atmosphere of radioactivity . . . will he have cause to brood on his self-destruction?

The answer lies in man's mind. *Man, the thinker.*

No miracle will attach itself to the control of atomic power. No miracle is attached to the conquest of the atom's power.

The answer in both cases rests, rather, in man's will to think . . . to believe . . . that little, if anything, is impossible.

For example, the technical principle, that of gaseous diffusion, by which Uranium 235 is separated, has been familiar to the laboratory since 1828! But how to separate this new element in relative *mass* quantities?

It was here that came the *essential meeting of minds* between the world's scientists and America's engineers and industrialists.

Together these men fashioned the *first* monument to the atom—a gaseous diffusion plant, called K-25, that compresses the world's greatest power into sixty acres of a valley in Tennessee. No Pharoah, dreaming of a pyramid, ever commanded such talent as this which matched the thinking of a global-team of "atomic scientists."

History's new Colossus—K-25—is a *fait accompli.* It bears a gift of new techniques that will revolutionize industrial processes. It provides a whole new family of chemical formulae. But none of these is the great contribution. For greater still is the truth that the men who harnessed atomic power have also grooved a path in man's mind for the decision on the use—and future—of that power: *Little, if anything, is impossible.*

---

**FOOTNOTES ON TECHNOLOGICAL ACCOMPLISHMENTS IN THE GASEOUS DIFFUSION PLANT, K-25 . . . DESIGNED BY THE KELLEX CORPORATION**

Development of the first, commercial-scale gaseous-diffusion "barrier" . . . a porous membrane for separation of light and heavy gases, containing hundreds of millions of pores per square inch of which the average diameter of each is estimated at two millionths of an inch.

•

Solution of corrosion problems presented by use of a gas that attacks all metals, non-metals, organics—even water—with equal relish. Installation specifications required that all working surfaces within the plant be free from contamination by even so much as a workingman's *thumbprint.*

•

A new method of fabrication of 100's of miles of corrosion-resistant pipe . . . installation into a vacuum-tight system.

•

Development of vacuum techniques and special instruments for *robot* detection of lethal gas leaks.

Development and manufacture on a mass scale of the most sensitive laboratory instruments in existence—thousands of special analytical, metering and control instruments, each of which is vacuum-tight and corrosion-resistant.

•

Development of pumps which operate at supersonic velocities—thousands of them; all non-leaking, non-corroding . . . including a variety of types of vacuum pumps, heretofore non-existent.

•

Development of a vacuum-tight heat-transfer system which employs an intermediate, neutral coolant which eliminates any danger of contamination or dilution of the product gas.

•

Completion, in essence, of the most complex process plant in industrial history. Work started on a basis of laboratory tests with plant in operation within two years' time.

# *THE* M. W. *KELLOGG COMPANY*

*Subsidiary:* THE KELLEX CORPORATION

NEW YORK, N. Y. • JERSEY CITY, N. J. • LOS ANGELES, CAL. • TULSA, OKLA. • HOUSTON, TEXAS • LONDON, EN

### Add Facilities to Skelly Oil Refinery at El Dorado, Kan.

NPN News Bureau

TULSA — Work is in progress at Skelly Oil Co.'s El Dorado, Kan., refinery on additional facilities to improve recovery of such C3 and C4 hydrocarbons as heretofore have been burned as refinery fuel and to permit processing them into poly gasoline and liquefied petroleum gases, according to J. W. Vaiden, vice president in charge of manufacturing.

Revamping for the most part includes additional fractionating equipment at the vapor recovery plant to process straight-run and cracked gases, installation of high pressure condensing equipment for the principal high-pressure cracking still, and additional distillation equipment at the poly plant and crude distillation section to handle the increased volume of vapors. No additional reactors will be necessary at the poly plant, however.

Repairs on a still recently damaged by fire also are in progress.

When the revamping is completed (about the latter part of April, 1946) a capacity increase of about 1200 b/d total of commercial propane, butane and polymer gasoline production will be realized, estimates indicate. Cost of the work was not disclosed.

### Two More Avgas Plants Up For Sale or Lease by RFC

NPN News Bureau

WASHINGTON — Government-built aviation gasoline plants operated by the Pennzoil Co. at Oil City, Pa. and the Mohawk Petroleum Corp. at Bakersfield, Calif. are being offered for sale or lease by RFC.

The Pennzoil plant includes 15 structures with 31,900 square feet of floor space, located on a site of 8.96 acres, and has alkylation and gas concentration units on the premises.

Mohawk's refinery occupies 20 acres of land, has about 20 service and functional units, and 30,000 square feet of floor space. There is a reforming unit, alkylation unit, isomerization unit, gas concentration unit, isopentane splitter, and laboratory and testing units.

## Sun Oil Head Says Refiners' Opportunities Threatened by OPA's Economic Strait-Jacket

Whether 1946 will be a year of great opportunities or one of dire consequences for petroleum refiners depends on decisions to be made in Washington, particularly as regards the present OPA economic strait-jacket in which the industry finds itself confined.

That is the opinion of J. Howard Pew, Sun Oil Co. president. He says that though prospects for ample crude supplies and steady expanding markets are bright, unless price controls are removed in peacetime, government restrictions threaten to destroy the oil industry's ability to serve the public.

Mr. Pew's complete statement follows:

The year 1946 can be one of great opportunites for petroleum refiners, or it can become one of disastrous consequences for the entire oil industry, depending in a large part on decisions to be made in Washington.

On the bright side are prospects for ample crude supplies and steadily expanding markets. Moreover, the oil industry is ready to go to provide consumers with the best products ever manufactured in our refineries at prices which they are willing and able to pay.

Darkening shadows in the picture as this year begins are the continued reluctance of Washington officialdom to relinquish wartime powers, particularly in the field of prices, and a newly-evidenced desire in that quarter to subject all industry to controls, which if effectuated, would amount to collectivism unless overcome and overcome quickly.

These trends will create an unemployment problem in the next few months that will strangle in its infancy a period of postwar prosperity and well-being for the American people. Specifically, if we cannot get OPA off our backs it will destroy us as an industrial instrument in maintaining a rising standard of living. There can be no compromise with this problem. OPA was created as a war agency at a time when all production was dedicated to winning the war and supplies were grossly inadequate for civilian demand and thus served a necessary purpose, but today the war is over and the oil industry is amply able to produce all the requirements for refined products of our civilian population as well as those of the government.

Consequently there no longer exists any reason for price ceilings on petroleum and its products. There are no problems attendant on oil supplies that a freely functioning market will not promptly solve. Continuation of OPA controls will only intensify old problems and create new ones. Already we have witnessed the dislocation of kerosine and fuel oil supplies as a result of price control. If this country suffers an acute fuel oil shortage this winter, OPA will be solely responsible.

If continued price control were necessary, and emphatically it is not, the OPA heirarchy has gone about its work in a wholly unrealistic manner. They have set price ceilings, for the most part, based on the economy of 1941, an economy that has little relation to the condition which exist today. Their decisions are made in a dream-world reminiscent of the simple-minded fellow who thought he could get a cold room warm by placing a match under the bulb of the thermometer.

We have heard much talk on the part of OPA and its propaganda supporter, the Office of War Information, to the effect that high prices cause inflation. This double talk is designed to deceive and confuse the public. It is a specious effort to put the cart before the horse. Actually price increases are one of the many disastrous results that follow in the wake of inflation and have nothing whatsoever to do with the cause of inflation. Actually the germs of the inflation which threatens us were hatched in the unsound and imprudent national policies of the past 15 years. There is nothing, OPA through price control, can do to prevent that inflation. It only can put a match under the thermometer in an effort to fool the people. Inflation can be stopped only by a reversal of the fiscal monetary and other policies which set it in motion.

The oil industry became one of America's great institutions for service to the public because of its competitive nature. If this industry is to advance it must be released from the OPA economic strait-jacket. This is the No. 1 problem for all of us large as well as small refiners. In the face of that problem all of our other difficulties play into insignificance, for no industry can prosper when any governmental body exercises the power of life and death over all or any of its units.

Long continued price control over the oil industry in peacetime is the surest way to destroy its ability to serve the public.

### Mexican Petroleum of Georgia To Expand Plant at Savannah

*Special to NPN*

SAVANNAH, Ga., — The Mexican Petroleum Corp. of Georgia announces plans for improvements at its plant here to cost approximately $110,000, with the view of increasing production some 20%.

Henry T. Hulin, plant superintendent, said the improvements call for stepping up "crude charging" capacity, additions to the distillation units, and doubling the size of the laboratory. The largest part of the outlay for improvements, will go into the erection of new tanks. One tank is to be of 80,000 bbl. capacity.

"While not entirely a result of the proposed improvements," Mr. Hulin said, "personnel of the plant will be increased by about 20% in the next few weeks. The union at the plant (Petroleum Workers of Savannah) recently voted a 40-hour, five-day week beginning Jan. 1."

# Cargoes Afloat!

**Partner with the automobile in the development of modern transportation . . . partner in the Victories of two World Wars . . . STA-VOL-ENE the "Natural" known throughout the World, is now ready for peace time cargoes to World Markets.**

# Hanlon-Buchanan, Inc

## PIONEER NATURAL GASOLINE MANUFACTURER

EXPORT TERMINALS:
Goodhope, La. Corpus Christi, Tex.
Houston, Texas Texas City, Texas
Baytown, Texas Galena Park, Texas

**TULSA 1, OKLAHOMA**
NATIONAL BANK OF TULSA BUILDING
PHONE 4-1101 or L.D. 358 WIRE — OR WRITE P. O. BOX 1559
Cable Address . . . STAVOLENE, Tulsa, U. S. A.

FOREIGN REPRESENTATIVE
Burke, Williams & Co., Ltd.
4 Lloyd's Ave.
London, England

**The billionth gallon of 100-octane produced by the company during the war is presented to Lieut. Gen. Ira C. Eaker, deputy commander of the AAF, by T. S. Petersen, director and vice president of California Standard. Contained in an ornate vial, it will be preserved by the AAF as a permanent exhibit. (Harris & Ewing Photo)**

## Long-Term Outlook for Natural Gasoline Seen Good; Effects May Not Be Felt During 1946

The long-term future of natural gasoline appears promising but its effects may not be felt during 1946. This is the opinion expressed by M. L. Arnold, president of California Natural Gasoline Assn. In response to an NPN query, Mr. Arnold said:

So long as the only significant consumers of natural gasoline continue to be the petroleum refineries, any forecast of the outlook for natural gasoline must be made from the refiner's point of view. This has been, traditionally, that a refinery is a plant for processing crude oil and that natural gasoline is merely a part of the white man's burden. It has been purchased along with crude oil with the same spirit of philosophical resignation exhibited by a liquor store patron purchasing a fifth of gin in order to get the bottle of scotch or bonded bourbon which he desires.

Necessarily then, natural gasoline has been assigned a value commensurate with the refiner's ability to use it to supplement products produced from crude. The advent of each new refining process has made this conventional use of natural gasoline more difficult.

Fortunately there is a ray of hope penetrating this cloud of gloom. During the war refiners generally became manufacturers of butadiene, cumene, toluene, alkalate, isomate, 100 octane fuel, and other new products. This experience has had a powerful effect upon the refiner's viewpoint.

The raw materials from which many of these new products were made were natural gasoline and the light hydrocarbons. So the refiner learned to consider these raw materials as desirable commodities, and their processing as being definitely within the scope of his operations. Of equal significance is the fact that many of the new products had actual or potential uses other than lubrication, heating or power generation.

As a consequence of these experiences the refiner has burst the cocoon of tradition which confined him to crude oil processing. Transformed into a manufacturer and synthesizer of products from all petroleum hydrocarbons, he has emerged into an almost limitless new sphere of activities.

This transformation and emergence promises much for the long-term future of natural gasoline, but its effects may not be felt during 1946.

### Refinery Expansion Set

Reuters News Agency

RIO de JANEIRO—The erection of an additonal distillation unit to the Companhia Brasileira de Petroleos refinery at Rio Grande has been approved by the National Petroleum Council.

## Refinery Equipment Price Control Eased

NPN News Bureau

WASHINGTON — Numerous items of refinery equipment have been exempted from price control, effective Dec. 31, including many types of valves, fittings and gauges. Action was taken in Amendment 7 to Supplement Order 129.

Refinery items exempted were:

Automatic regulating valves and float valves, larger than 3 inches IPS or designed to operate at pressures in excess of 300 lbs. per square inch; automatically and manually operated safety and relief valves, including all steel body safety and relief valves and all safety and relief valves of any type designed to operate at 250 lbs. per square inch or higher pressures, except combination temperature-pressure relief valves for hot water supply systems.

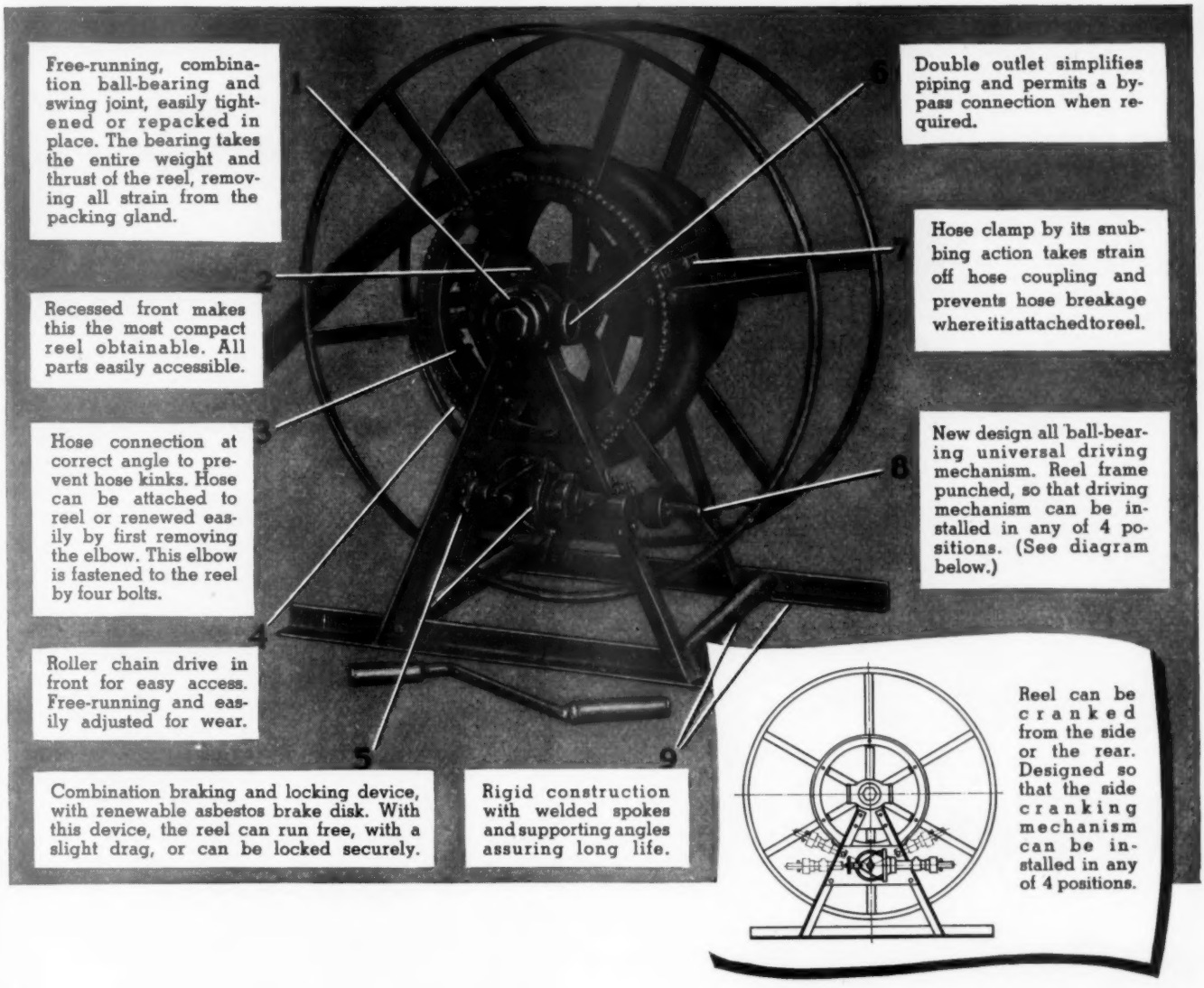
All pipe fittings manufactured from steel, carbon steel or alloy steel, having screwed, flanged or welding ends, regardless of size or pressure, except steel welding fittings and flanges designed to operate at pressure less than 250 lbs. per square inch; all forged steel fittings, screwed ends, flanged ends, and welding ends, except steel welding fittings designed to operate at less than 250 lbs. per square inch pressure.

#### Valve Types Listed

All valves having steel, carbon steel or alloy steel body; all valves having forged steel body; all valves having copper-base alloy bodies larger than 4 inches IPS; all valves having ferrous bodies larger than 8 inches IPS; all valves having ferrous bodies with hubends; all manually-operated, motorized and motor-operated valves designed to operate at pressure exceeding 250 lbs. steam working pressure per square inch, regardless of size or material.

All screwed end and flanged end pipe fittings and pipe unions designed to operate at pressures exceeding 250 lbs. steam working pressure per square inch, regardless of size; all iron, bronze or steel lubricated or asbestos packed plug valves; all types of bronze fittings and valves with ends for high temperature brazing, but not including fittings or valves using solder materials for jointing.

All steel turbine valves; perfection oil gates; all single pressure and multi-pressure 2, 3 and 4-way hydraulic valves; cast iron pressure pipe and fittings, and indicating pressure gauges, including all indicating pressure test gauges, and gauges with cast cases and dial faces 4½ inches in diameter or larger, pressed metal cases with dial faces 6 inches in diameter or larger, and cast or phenolic plastic cases and made to any Navy specifications.


1
Free-running, combination ball-bearing and swing joint, easily tightened or repacked in place. The bearing takes the entire weight and thrust of the reel, removing all strain from the packing gland.
2
Recessed front makes this the most compact reel obtainable. All parts easily accessible.
3
Hose connection at correct angle to prevent hose kinks. Hose can be attached to reel or renewed easily by first removing the elbow. This elbow is fastened to the reel by four bolts.
4
Roller chain drive in front for easy access. Free-running and easily adjusted for wear.
5
Combination braking and locking device, with renewable asbestos brake disk. With this device, the reel can run free, with a slight drag, or can be locked securely.
Rigid construction with welded spokes and supporting angles assuring long life.
6
Double outlet simplifies piping and permits a by-pass connection when required.
7
Hose clamp by its snubbing action takes strain off hose coupling and prevents hose breakage where it is attached to reel.
8
New design all ball-bearing universal driving mechanism. Reel frame punched, so that driving mechanism can be installed in any of 4 positions. (See diagram below.)
9
Reel can be cranked from the side or the rear. Designed so that the side cranking mechanism can be installed in any of 4 positions.

# *The New Hose Reel You Have Been Looking For*

**COMPACT, RUGGED, LIGHT IN WEIGHT, BALL-BEARING CONSTRUCTION THROUGHOUT**

The New Philadelphia Valve Co. reel is the finest reel built. It is compact, rugged, and light in weight. All parts are of steel, malleable iron, or bronze; no cast iron is used. It is ball-bearing throughout with hardened and ground races. (6 ball bearings are used.) It will never wear out.

The reel can be changed from top winding to bottom winding by reversing the hose connection and rotating the drum. All working parts and hose connections are in front and easily accessible. It is light in weight, a reel that holds 100 feet of 1½" hose, weighs only 93 pounds.

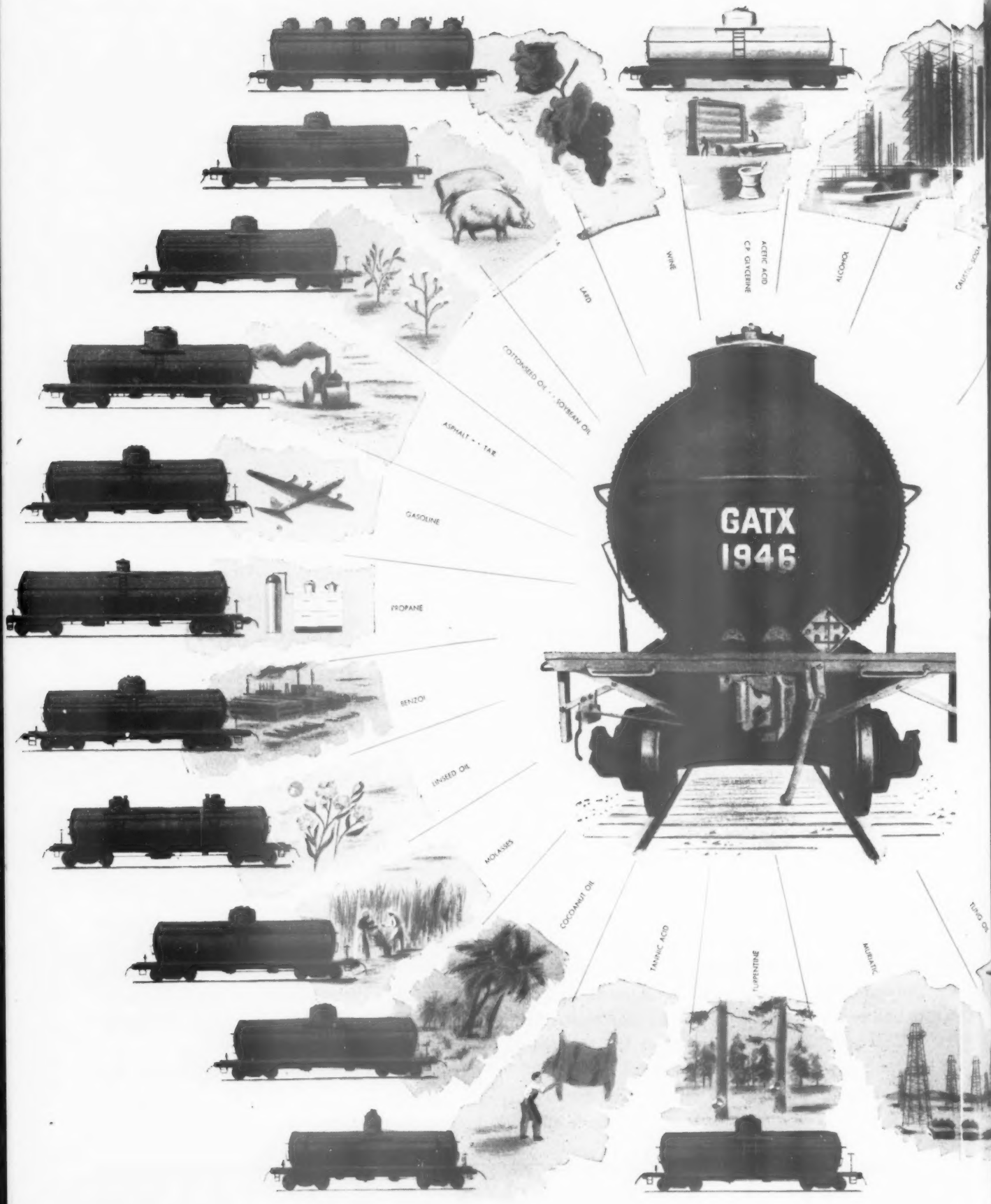
We can furnish hose reels in any size or shape. They can be furnished for installation either in bucket box at rear of truck or in underslung box on side of truck. Give inside dimensions of box when writing for information. Special reels can also be furnished for Airfield Refueling Pits and Ship Docks.

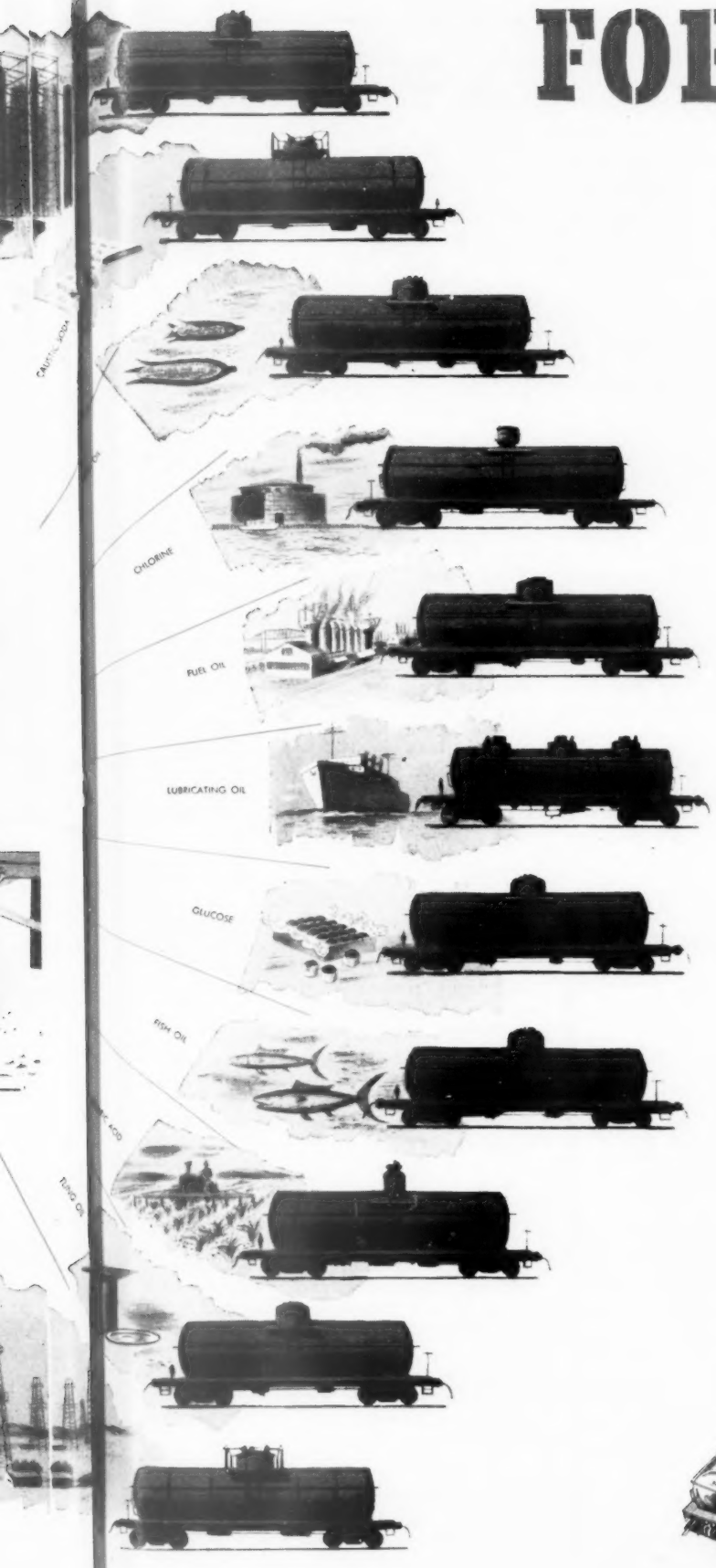
Delivery can generally be made in a few days after receipt of order. For sizes, prices, and dimensions, write for Catalogue No. 165.

**PHILADELPHIA VALVE COMPANY**

ARAMINGO AVENUE AND ONTARIO STREET, PHILADELPHIA 34, PA.

Oil Marketing Equipment Company, 321-325 Fremont Street, San Francisco 5, Cal.


GATX
1946
LARD
WINE
ACETIC ACID
C.P. GLYCERINE
ALCOHOL
COTTONSEED OIL - - SOYBEAN OIL
ASPHALT - - TAR
GASOLINE
PROPANE
BENZOL
LINSEED OIL
MOLASSES
COCOANUT OIL
TANNIC ACID
TURPENTINE
MURIATIC




# FOR RENT

**37,000 Specialized Tank Cars—**
**207 Types—For Swift, Sure, Economical Transportation of Liquids in Bulk**

•

GATX tank cars—207 types from 4,000 to 12,500 gallon capacities—haul an almost infinite variety of liquids: from propane to port wine to pine tar.

•

Strategically located offices, plants and repair shops throughout the nation give General American the unique ability to provide shippers precisely the kind of tank cars they want, *when* they want them, *where* they want them.

•

These tank cars are for rent. So, if the cargo is bulk liquid and the problem safe, fast, economical transportation—count on General American.

•

*Take your tank car problems to our nearest office*

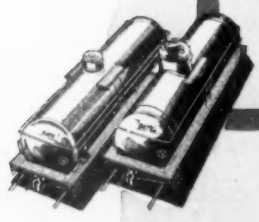
•

**GENERAL AMERICAN TRANSPORTATION CORPORATION**

General Offices: 135 South La Salle Street, Chicago 3, Illinois

**DISTRICT OFFICES:**

| | | |
|---|---|---|
| New York | Los Angeles | New Orleans |
| St. Louis | Dallas | Tulsa |
| Buffalo | Houston | Cleveland |
| Seattle | | Pittsburgh |



**GENERAL AMERICAN TRANSPORTATION**
CORPORATION
CHICAGO

# Welcome Back . . . . . .

**Lieut. D. F. Graham,** son of **B. F. Graham,** owner of National Oil Co. of Hastings, Nebr., is now at home on terminal leave with his discharge coming up this month. He joined the Navy in June, 1942, was a supervisor of an ammunition depot and interested in Navy athletics.

Lieut. Graham

Another son, **Jack Graham,** became a Marine paratrooper after enlisting in February, 1941 and is still serving. He has been in a number of hot spots—Iwo Jima, Vella-Vella and Choisale near Tarawa. He has been wounded three times. In addition to the Purple Heart, he was awarded the Silver Star for heroism on Iwo Jima. His citation reads: ". . . . For conspicuous gallantry and intrepedity in action against the Enemy while serving with Marine Infantry Battalion on Iwo Jima, Volcano Island, on February 24, 1945. . . He conducted three tanks forward of our lines and into position to fire on the enemy."

◆ ◆ ◆

Staff Sgt. **Delbert Grim,** 27, is back distributing Skelly oil products at Ansley, Nebr., with his father, head of O. J. Grim & Son. He received his discharge Nov. 30, from Co. D, 53rd Bn, 11th Regiment, after 16 months at Camp Fannin, Tex. He trained infantrymen in the use of rifles, machine guns, automatics, bazookas, grenades, rifle launchers, mortars and flame throwers. He was wounded when a shell fell short and flying pieces caught him in the back and right leg on July 17, 1945. He spent three weeks in the hospital. He wears an Expert Infantry badge, Good Conduct Medal, American Defense and Victory Medal.

◆ ◆ ◆

**Capt. E. J. (Sully) Griffin,** formerly sales manager for Southern California's Shell Oil Co., has been awarded the Legion of Merit for services overseas in managing the tank truck section of the Army's Transportation Corps. Capt. Griffin had charge of that section consisting of 700 tank trucks, from the time of its landing on the Normandy peninsula with the first invasion forces, until the final push was made into Germany. In his citation he was commended for filling 400,000 empty 5-gallon jerry cans that had accumulated on the Utah Beach on the peninsula, filling them and getting them up behind the Army ready for the break-through. Capt. Griffin ran his tank truck section behind the rapidly advancing armies in 1941 and during the winter was pushing them on into Belgium and Germany.

◆ ◆ ◆

**Benjamin Harrison,** back with Ethyl Corp. after service with the Army Air Corps, is now manager of the Industrial Engineering Section at Baton Rouge. Before entering the Army in January, 1942, Mr. Harrison was special assistant to Ethyl's manufacturing head, **John H. Schaefer,** in New York.

After six months at the Fort Niagara Reception Center, Mr. Harrison was assigned to the Maintenance Division of the Air Service Command and sent to the Middletown Air Depot at Middletown, Pa. Later he was assigned to Wright Field, Dayton, Ohio, where he served for two and a half years.

◆ ◆ ◆

**Lieut. Col. Jerry Sadler,** former Texas Railroad Commissioner, "may have to pitch a pup tent on the court house lawn" at Longview to find a place to live. Col. Sadler, just discharged from the Army after serving in India and Persia, is finding civilian clothing and a place to live his chief problems, like many returning soldiers. Col. Sadler resigned from the Railroad Commission in 1942 and entered the Army as a Private. He has definitely announced he will run for governor of Texas this year.

◆ ◆ ◆

**Jack Shaw,** recently released from the Army Air Corps after 44 months of service, has been appointed publicity director of the Tidewater Associated Oil Co. **Elmer Thuener,** former advertising assistant at Associated, has returned to his former position after spending 14 months in the Pacific theater.

◆ ◆ ◆

After 21 months in the Army doing personnel and classification work in the United States **E. H. Quickert** has returned to his former position as marketing service manager with Shell Oil Co., Inc., at Chicago. Mr. Quickert joined Shell in 1929 and has been in the Chicago office since 1936.


WOOD RIVER

QUALITY PRODUCTS AVAILABLE TO THE INDEPENDENT JOBBER

ETHYL and all grades of leaded and unleaded gasoline
TRACTOR FUEL DIESEL FUEL
ASPHALT KEROSENE
Numbers 1, 2, and 3, DOMESTIC FUEL OIL
RANGE OIL INDUSTRIAL FUEL OIL

SALES OFFICES:

HARTFORD, ILLINOIS
ST. PAUL, MINNESOTA
Phone Wood River 4-4374
Phone De Soto 5533
P. O. Box 145
1700 Stewart Avenue

HOME OFFICE:
WICHITA, KANSAS

WOOD RIVER OIL AND REFINING COMPANY, INC.

KEEP OIL FREE FROM ABRASIVES WITH

# PUROLATOR

THE OIL FILTER

Purolator has in this filter the greatest development in the history of the oil filter industry

WATCH
MARCH 6th
NATIONAL
PETROLEUM NEWS

PUROLATOR PRODUCTS INC.
NEWARK 2, N. J.
*Founder and Leader of the Oil Filter Industry*

## Welcome Back

**Lieut. William H. Katt,** son of Herbert Katt, High Speed Oil Co., Racine, Wis., is now on terminal leave, expecting his discharge on Jan. 20, 1946. He will then be back in the oil business with his father. He wears a Purple Heart and Air Medal and has a Presidential Unit Citation. He landed in Scotland on Armistice Day, 1944, and joined the 315th Troop Carrier Group at Leicester, England, as co-pilot of a C-47. He assisted in dropping British paratroops over the Rhine near Wessel, Germany in March, 1945. He was wounded in the left arm on March 24. His three battle stars are for Ardennes, Rhineland and Central Germany.

Lieut. Katt

♦ ♦ ♦

**J. H. Sembower,** back from three years in the Navy, where as lieutenant he spent 21 months in combat in New Guinea, Pelelieu and other South Pacific spots, has been appointed manager of personnel and industrial relations department in Shell Oil Co.'s Texas-Gulf area, with headquarters at Houston. Mr. Sembower has been with Shell eight years, serving in the company's marketing, head office, personnel and public relations departments.

♦ ♦ ♦

**Sgt. L. D. McGuan,** former NPN writer, got what he described as a "pleasant surprise" when he found a dog-eared copy of NPN on a LST which was taking him from Hawaii to Leyte.

"I made inquiry," he wrote NPN Editor Warren C. Platt, "but could not find the original owner. I kept the magazine for about a month, but lost it somewhere along the route."

Sgt. McGuan was employed by The Texas Co. in Chicago when he entered the Army.

♦ ♦ ♦

**Capt. Ron Gleason,** recently discharged after four years' service with Army Ordnance, has been appointed office manager and treasurer of The Chek-Chart Corp., according to announcement by Ray Shaw, president. Capt. Gleason attended Antioch College and Northwestern University, and worked in the plants and offices of tube and steel companies at Clairton, Pa. He was on the line when the present Pontiac car was being produced, engaged in operative studies on various assembling operations.

## No Freak Designs Seen In Postwar Highways

NPN News Bureau

WASHINGTON — Charles M. Upham, engineering director of the American Road-Builders' Assn. says, "Don't look for freak design in postwar highways."

Oil men, whose ultimate retail marketing outlets will be located on these highways of the future are advised to ponder his comments with an eye to the high-speed motor business of the future.

Basing his argument on the fact that "America is emerging from four years of war in which its roads and streets have suffered tremendous punishment," Mr. Upham said:

"Only 49% of the country's 1,928,000 miles of county and local roads have all-weather surfacing. Only 73% of the 304,000 miles of municipal streets and alleys have surfaces of concrete, asphalt, tar coating, gravel or stabilized earth. Even in the better cared for state-controlled highways, 17% of the 563,520 miles still lack such surfacing. . . . .

"Furthermore, it is interesting to note that only 20,879 miles or 6% of our 333,000 miles of primary rural highways have more than two traffic lanes, and from this may be deducted the 14,661 miles of three-lane highways which should be widened to four as a safety measure. . . .

"Still another fact bearing on the work to be done is the estimate made in 1940 that $3,500,000,000 would be required to rebuild, widen or relocate 106,560 miles of highway that had become obsolete with an additional $500,000,000 for widening or rebuilding 21,682 bridges. . . .

"A feature of the postwar highway construction program will be the 40,000 miles of interstate highway connecting practically every city of 100,000 more population in the United States. While this great system will carry about 20% of all motor traffic, it will represent only about one and one-third per cent of the total mileage of rural roads and urban streets in the United States. . . .

"As contemplated, a typically heavily travelled section of this interstate system will have entrances and exits only at selected points, a 300-ft. fenced right-of-way attractively landscaped, grade separations at all intersections, no stop lights, four-lane movement, all traffic moving in opposite directions, divided by a 15-foot center strip, occasional moderate grades, easy super-elevated or banked curves at frequent intervals, and continuous unobstructed view ahead for at least 800 feet."

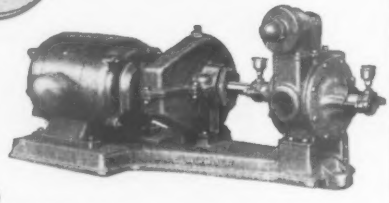
### Gets Oil Hauling Permit

NPN News Bureau

WASHINGTON — ICC recently authorized a certificate to the Oklahoma Bituminous Co. of Chickasha, Okla., to operate over irregular routes in the hauling of crude and fuel oils, and petroleum asphalt in tank trucks between points in Oklahoma and Texas.


BLACKMER PUMPS

The Key to



- Lower Pumping Costs
- Sustained Pumping Capacity
- Pump Dependability

Write for Bulletin No. 102
PUMPS FOR THE PETROLEUM INDUSTRY

which explains why the "Bucket Design" (swinging vane principle) maintains pumping capacity by automatically compensating for wear and how the buckets, when finally worn out, are easily replaced and the pump restored to its normal capacity

BLACKMER PUMP COMPANY
1880 Century Avenue Grand Rapids 9, Mich.

SERVING THE PETROLEUM INDUSTRY FOR OVER 40 YEARS
BULK STATION PUMPS · TRUCK PUMPS · HAND PUMPS

**this trouble-free running gear . .**

## one of the many reasons why Heil "Trailerized" (frameless) Tanks *keep rolling . . . dependably*

With Heil "Trailerized" construction, you can count on fewer road delays due to breakdowns. Night and day, around the clock, this Quality-built equipment keeps rolling. One prominent operator reports a month's mileage equal to 10 round trips to Berlin, without a single delay due to "Trailerized" tank failure — on 23-hour service, with only a half-hour out in each shift for gassing and servicing.

Behind this record are the solid accomplishments of Heil engineers, typified by the trouble-free running gear illustrated here. Heil's basic "Trailerized" design, a proved success since 1936, was the pioneer in reduction of dead weight and boosting of payload. Heil design assures you of maximum payload, equal for a given gross weight to that of any other equipment made.

The payoff is on *total gallonage*, by the day, month, or year — resulting from safe, steady, uninterrupted service. You get the most for your money, with dependable Heil equipment.

T-79

**Heil Quality-Built Running Gear for "Trailerized" (frameless) Tanks**

Equipped with heavy-duty springs and rubber-bushed radius rods. Both ends of the spring slip through the brackets. The axle is held in alignment by the radius rods, which relieve the springs of all pulling or twisting strains. This Heil running gear plays an important part in the day and night operation of Heil "Trailerized" Tanks.

ARMY NAVY

**THE HEIL CO.**

General Offices • MILWAUKEE 1, WISCONSIN

**3 out of every 4 sales of HEIL "Trailerized" Tanks are REPEAT orders from satisfied users**

# never GAMBLE ON FIRE PROTECTION...

## STANDARDIZE YOUR EQUIPMENT WITH PYRENE

You gamble with fire when you install only one type of extinguisher if you have hazards that call for two or more different types. Today's production, industrial growth and building expansion ought to have the maximum fire protection provided by Pyrene equipment. Specifically designed, tested and approved for each particular hazard it will give you maximum fire protection where and when you need it. Determine now whether you have adequate fire protection—if your extinguishers are ready to meet any emergency. Ask your Pyrene jobber to show you how to properly protect your property.

for class A fires
WOOD, TEXTILES, RUBBISH. USE PYRENE SODA-ACID, FOAM, CARTRIDGE-OPERATED OR PUMP TANK WATER AND ANTI-FREEZE TYPES.
for class B fires
Pyrene FOAM
GASOLINE, PAINTS, OILS AND FLAMMABLE SOLVENTS. USE PYRENE FOAM AND VAPORIZING LIQUID EXTINGUISHERS.
for class C fires
ELECTRICAL EQUIPMENT WHERE EXTINGUISHING AGENT IS A NON-CONDUCTOR. USE PYRENE VAPORIZING LIQUID EXTINGUISHER.

Pyrene Manufacturing Company

NEWARK 8 NEW JERSEY

Affiliated with the C-O-Two Fire Equipment Co.


## E. O. Slater Named Chairman of S. Calfi. Section of A.I.M.E.

NPN News Bureau

LOS ANGELES—A meeting of the Southern California Section of the American Institute of Mining and Metallurgical Engineers was held recently at the University Club in Los Angeles.

A resolution to amend the Wagner Labor Relations Act was passed by the group. This resolution, which is to be presented for national action, divides the professional engineer from other workers in order that he may be represented separately and provided with a bargaining unit composed of professional engineers.

The speakers were Dr. William Fowler, associate professor of physics at the California Institute of Technology, who spoke on "Nuclear Fission and Atomic Energy" and Harvey Mudd, national president of the A.I.M.E.

The election of officers resulted as follows: chairman, E. O. Slater, vice-chairman for mining, Hugh R. Van Wagenen, vice-chairman for petroleum, Tom Atkinson, secretary and treasurer, Harold J. Clark, members of the executive committee, Carlton Beal, Lawrence W. Chasteen, Walker S. Clute, William H. Geis, S. Paul Lindau and John P. De Hettre, member of the executive committee representing Junior A.I.M.E. of Southern California.

## National Butane-Propane Assn. Lowers Dues in Member Drive

*Special to NPN*

MINNEAPOLIS — National Butane-Propane Assn., in a campaign for new members, has lowered its annual dues, according to E. E. Hadlick, President. Active membership is limited to liquefied petroleum gas operators of bulk storage facilities of tank car or more capacity. Others are eligible for association memberships.

The newly announced schedule of dues for active members is $50 for operators doing less than $50,000 in sales annually; $75 dues for $50,000 to $99,000 in sales; $150 dues for $100,000 to $199,000 in sales; $400 dues for $200,000 to $499,000 in sales; $1,000 dues for $500,000 to $999,000 in sales. For operators doing $1,000,000 or more in annual sales, the dues were fixed at $2000.

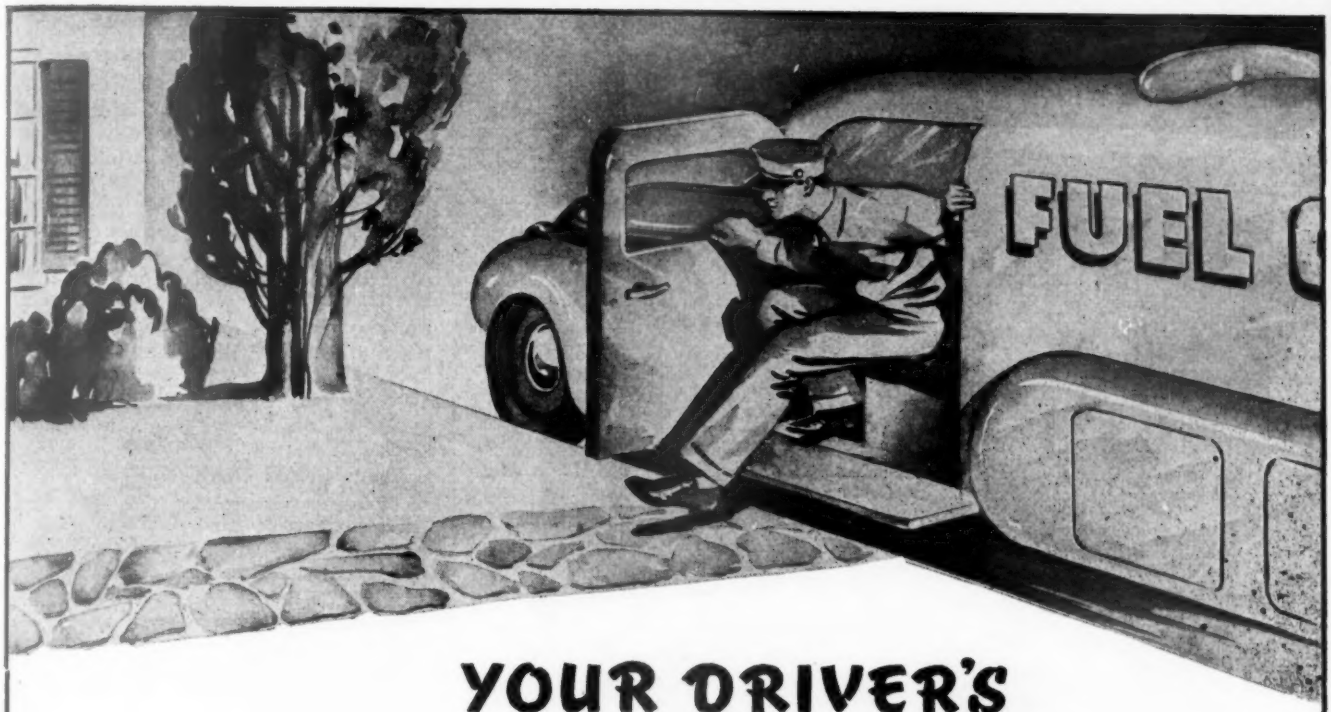
Dues for non-voting associate memberships were set at 50% of the amount charged active members.

## Named Treasurer of Stanolind

NPN News Bureau

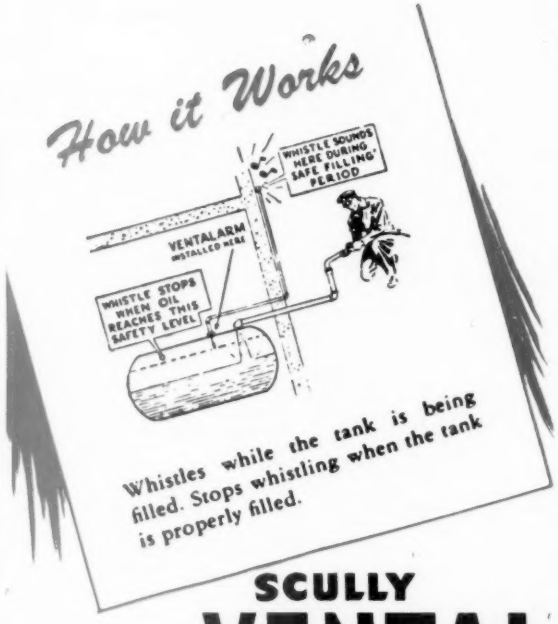
TULSA — F. J. Ryan has been appointed treasurer of Stanolind Oil Purchasing Co. to succeed A. L. Carlson, who resigned as secretary and treasurer. Mr. Ryan formerly was assistant secretary and treasurer. Henry Waters, vice president, will add secretary's duties and title to his own present responsibilities.

H. L. Crosby has been named assistant treasurer and Eloise V. Adams as assistant secretary.




# YOUR DRIVER'S NEXT MOVE

## largely determines your fuel oil delivery profit or loss . . . .


How it Works
WHISTLE SOUNDS HERE DURING SAFE FILLING PERIOD
VENTALARM INSTALLED HERE
WHISTLE STOPS WHEN OIL REACHES THIS SAFETY LEVEL
Whistles while the tank is being filled. Stops whistling when the tank is properly filled.

If you have VENTALARM equipped this householder's fuel oil tank you have planned in advance your driver's "next move," — he'll turn to the truck and start unreeling. In less than two minutes he'll have made the hook up and started pumping.

Guided by the whistle signal he'll fill the tank, reel up, make out his ticket and be off to the next stop with a saving of at least *five minutes* over the non-VENTALARM, entry-into-the-home method.

What is five minutes of truck and driver time saved on every delivery you make worth to you?

**SCULLY**

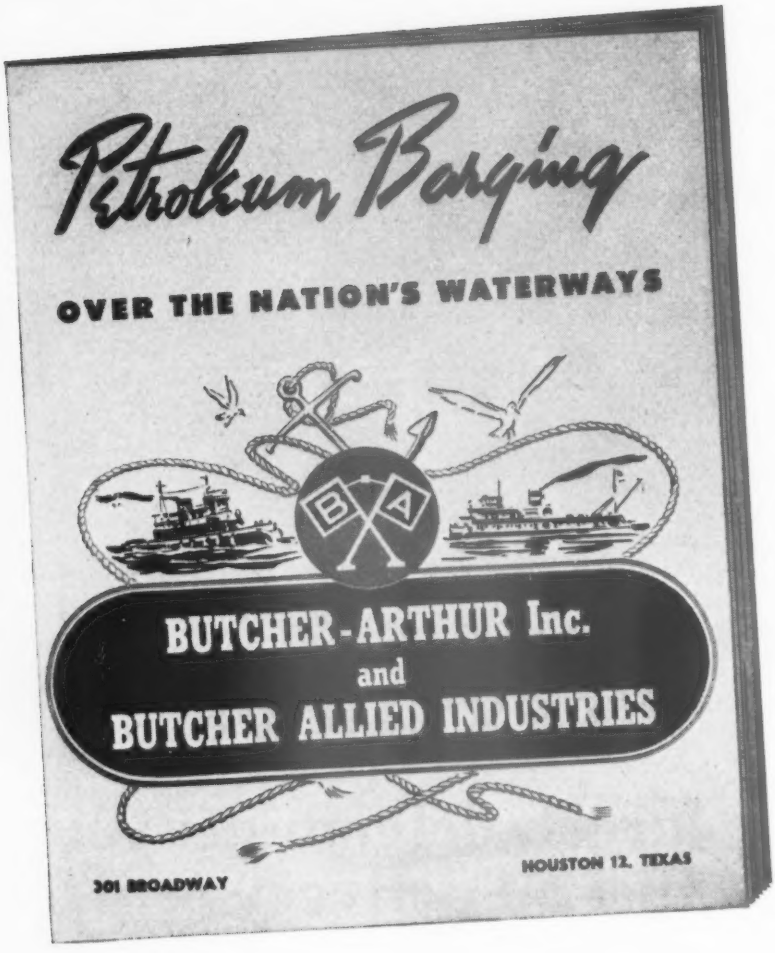
# VENTALARM

T.M. REG. U.S. PAT. OFF.

*The Whistling* **FUEL TANK SIGNAL**

*Also Standard Equipment on* AUTOMOBILES, BUSES, TRUCKS *and* LOCOMOTIVES

**SCULLY SIGNAL COMPANY, 88 FIRST ST., CAMBRIDGE 41, MASS.**




# Write for your FREE COPY of this new 20-page booklet

Want a listing of terminals, locations, mileage from key point on the waterway, and barrels capacity? Want a map of the inland waterways of the nation with towns or terminals shown? You'll find all this and more in our new booklet, "Petroleum Barging Over the Nation's Waterways," just off the press. Whether you're interested in terminals and points along the Intra-Coastal Canal, the Mississippi or Ohio Rivers and the tributaries, you'll find the complete listing in this new booklet. Strip maps are shown of each section, and then in the back of the booklet you'll find a large map of the whole inland waterways system .Write now for your free copy of this booklet; it'll be sent to you by return mail. It contains a wealth of information you'll want to keep at your finger tips for handy reference.

**BUTCHER-ARTHUR Inc.**

**301 Broadway** **Houston 12, Texas**

## A.I.M.E.'s Petroleum Group To Meet in Chicago Feb. 28

NPN News Bureau

CHICAGO — Two sessions of the Economics Section, Petroleum Division of the American Institute of Mining and Metallurgical Engineers, will be held at the Palmer House here Feb. 28. Brad Mills and J. D. Gill will preside.

The following papers will be presented at the two sessions:

"The Trend in Costs of Replacing Petroleum Reserves," James V. Brown, petroleum analyst, Independent Petroleum Assn. of America.

"U. S. Proven Crude Reserves vs. Price," Charles Deegan, associate editor, Oil & Gas Journal.

"Productivity, Prices and a Sound Wage Level," J. D. Gill, economist, Atlantic Reining Co.; B. A. Stainton, research assistant, Atlantic Refining.

"Correlation of Drilling with Production Requirements," Brad Mills, executive secretary, American Assn. of Oilwell Drilling Contractors.

"Trends in Relative Foreign and Domestic Petroleum Operations,' Howard W. Page, economics department, Standard Oil Co. of New Jersey.

"Economic Pattern of Oil Pipelines," G. L. Shanks, valuation engineer, Pure Oil Co.

## Dr. Robert E. Wilson Named Councilor of the A.C.S.

NPN News Bureau

NEW YORK — Dr. Robert E. Wilson, chairman of the board of the Standard Oil Co. (Ind.), is one of four leaders in chemistry and chemical engineering recently elected councilors-at-large of the American Chemical Society, it is announced.

In addition to Dr. Wilson, those named for three-year terms to the council, the society's advisory body on policy and general management, are:

Dr. Lewis W. Bass, director of chemical research of Air Reduction Co., and director of research and development for United States Industrial Chemicals; Dr. Ralph L. Shriner, chairman of the chemistry department of Indiana University; and Dr. Hobart W. Willard, professor of chemistry in the University of Michigan.

## Oklahoma Oil Scouts Assn. Elects J. E. Austin President

*Special to NPN*

SULPHUR, Okla.—J. E. Austin, Oklahoma Natural Gas Co., Shawnee, Okla., was elected president of Oklahoma Oil Scouts Assn. at a state wide meeting held here Dec. 14.

J. E. Rogers, Stanolind Oil & Gas, Oklahoma City, was named vice president; K. A. Heckman, The Texas Co., Ardmore, secretary-treasurer; Henry Brock, Magnolia Petroleum Co., Oklahoma City, editor of Oklahoma Division of National Oil Scouts and Landmen's Assn. Year Book.

# Compliance Service On Oil Regulations

## Digest of Regulations Issued Weekly Regarding Oil and Oil Equipment

(December 22-29, 1945)

**OFFICE OF PRICE ADMINISTRATION**

**DESIGNATING A RECYCLING PLANT AS A REFINER; AND FIXING MAXIMUM PRICES FOR KEROSINE, RANGE OIL AND NO. 1 FUEL OIL F.O.B. REFINERIES AND/OR TANKER TERMINALS IN VARIOUS DISTRICTS—MPR 88—Am. 38**—A recycling plant shall be considered a refinery in exchanges or sales of petroleum products, other than natural gasoline, between refiners.

As a result of the imminent shortage of kerosine and fuel oil, temporary price increases above existing prices in kerosine, range oil, stove oil and No. 1 fuel oil of 5c per gallon until April 30, 1946 f.o.b. refinery or tanker terminal located in PAW Dist. 3, for ultimate destination in PAW Dist. 1—Atlantic coast area.

F.o.b. and/or delivered prices in PAW Dist. 1 an increase of 5c per gallon above existing price until April 30, 1946, in kerosine, range oil and No. 1 fuel oil, except in schedule D area, and export sales or to exporters.

F.o.b. refinery and/or tanker terminals located in PAW Dist. 3 for ultimate destination in PAW Dist. 1, temporary increase of 2c per gallon above existing price until April 30, 1946, in No. 2, No. 3 and No. 4 fuel oil, excepting schedule D area and export sales on sales to exporters. Issued 12-19-45, effective 12-19-45.

**TEMPORARY INCREASES IN PRICE OF KEROSINE, RANGE OIL AND NO. 1 FUEL OIL IN ATLANTIC COAST AREAS OF 5c PER GALLON ABOVE EXISTING PRICES—Rev. MPR 137, Amdt. 17**—Petroleum products sold at retail establishments and certain other retail sales, a seller's maximum price for kerosine, range oil, stove oil and No. 1 fuel oil in the Atlantic coast area including states of New York, Pennsylvania and West Virginia, and Florida east of the Apalachicola river; except Schedule D area, shall be the maximum price plus 5c per gallon, until April 30, 1946. Issued 12-19-45, effective 12-19-45.

**EXEMPTION AND SUSPENSION FROM PRICE CONTROL OF CERTAIN MACHINES AND PARTS, INDUSTRIAL MATERIALS AND SERVICES—Supp. Order 129, Amdt. 7**—Exempts and suspends from price control certain machines, parts, industrial materials and services, including specified articles of millwork, nonferrous metals, motor vehicles and equipment; limited use of rubber; mechanical building equipment, piping and plumbing accessories, electro-therapeutic apparatus and other miscellaneous articles and services. Issued 12-26-45, effective 12-31-45.

**TIRE RATIONING ABOLISHED—Ration Order 1-A**—Subject to section 5.1 of General Ration Order 8, Ration Order No. 1A (Tires, Tubes, Recapping and Camelback) and all Office of Price Administration revocation or suspension orders, to the extent that they relate to tires, tubes, recapping and camelback, are revoked. Issued 12-26-45, effective 1-1-46.

**CIVILIAN PRODUCTION ADMINISTRATION**

**RESTRICTIONS CONTROLLING THE USE OF LEAD AND LEAD PRODUCTS—Gen. Pref. Order M-38, as am. Dec. 19-45**—Requirements for national needs have created a shortage in the available supply of lead for private account and for export. This order controls generally the use of lead and lead products. Lead and lead products may be used only for the items and purposes set forth in the order. Other restrictions may also be found in other orders of the Civilian Production Administration relating to particular articles or parts. Issued 12-19-45, effective 1-1-46.

CODE: AO—Administrative Order; CMP—Controlled Materials Plan; D—Directive; FDO—Food Distribution Order; GMPR—General Maximum Price Regulation; GO—General Order; Interp.—Interpretation; L—Limitation Order; M—Conservation Order; MPR—Maximum Price Regulation; P—Preference Rating Order; PAO—Petroleum Administrative Order; Pri. Reg.—Priorities Regulation; Proc. Reg.—Procedural Regulation; PS—Price Schedule; RO—Ration Order; RPS—Revised Price Schedule; SO—Supplementary Order; SR—Supplementary Regulation.

## Appellate Court Rules OPA Not Bound by Group Pricing

NPN News Bureau

WASHINGTON—U. S. Emergency Court of Appeals has ruled OPA is not bound to follow a group pricing method in establishing maximum prices where such a method is not in line with the level of prices that prevailed or would have prevailed during a base period.

The decision, handed down in the case of Saunders Petroleum Co. V. Chester Bowles, price administrator, affirmed OPA's action in establishing a maximum price of 4.11c per gallon for deliveries of residual fuel oil to the Nebraska Defense Corp., an ordnance plant at Mead, Neb.

OPA established the price after Saunders failed to report a tentative sales price as required by MPR 88. Saunders contended the order was arbitrary, capricious and improperly issued.

## OPA Announces Simplified Cooperage Ceiling Prices

NPN News Bureau

WASHINGTON Exporters of new tight cooperage (barrels used for shipping oils and other liquids) and new tight cooperage stock (staves and heading used in making barrels) have been given a simplified method of determining ceilings prices, OPA has announced.

Exporters may now take the maximum price for a domestic sale of the same article and add a specified export premium, as well as any commission up to 5% paid to a foreign agent, any discount allowed up to 2½%, and the other usual export expenses incurred.

## RFC to Sell Aviation Oil

WASHINGTON — RFC is accepting informal bids on 1,300,000 gallons of grade 1080-P aviation engine oil, now at Standard Oil Co. (California) terminal storage in Wilmington, Calif. The oil will be sold Jan. 14 through RFC's Los Angeles office.

## British Gasoline Rationing For Aircraft Announced

Reuters News Agency

LONDON—Details of a new gasoline rationing scheme for civil flying announced recently permit private owners to draw gasoline equivalent to four hours flying for their aircraft each month.

Flying clubs and taxi companies will be rationed according to the number of aircraft in use. The quantities available for various uses are:

PRIVATE FLYING—Gasoline equivalent to four hours flying a month.

FLYING CLUBS—The equivalent to 50 hours flying per month per aircraft.

TAXI SERVICES AND CHARTER FLIGHTS—Gasoline equivalent to 60 hours per month per aircraft.

## Federal Court Refuses Stay In Cement 'Basing Point' Case

NPN News Bureau

WASHINGTON—Motion of Cement Institute and Cement industry defendants for an indefinite stay of Justice Department's anti-trust action, pending final disposition of appeal from FTC cease and desist order of July 17, 1943, has been denied by Colorado District Court.

Defendants have been given until Jan. 15 to file any preliminary motions, and until Feb. 26 to answer Justice Department charges. Case involves use of "phantom freight rates," resulting from basing point system.

## FSA Reports Neat Profit

INDIANAPOLIS, Ind. — Profit of $176,000 has been reported by the Federal Farm Security Administration in resale of 3,406 acres of Indiana farm land in Benton and Tippecanoe Counties out of 15,000 acres bought by the government for wartime industrial and military installation. The land was bought for $805,715 and resold for $982,053, George Reuss, regional director of FSA reports. The gross profit of 22% and 75% of the oil and mineral rights (withheld by the government in resale) are considered "velvet" FSA officials said.

## PAW Revokes Directive 70

WASHINGTON — Formal revocation of Directive 70 was signed Dec. 21 by Deputy PAW Davies, effective Dec. 31. Signed also, effective the same date, was the revocation of PAW Recommendation 24, which provided for the Petroleum Industry War Council.

## Acts in Tidelands Case

WASHINGTON — Massachusetts has filed leave with the Supreme Court to intervene in the government's action against California concerning ownership of Tidelands. California has until Jan. 28 to answer government's complaint.

## Consumers Co-operative Assn. Reports New Records Set in Business Volume for '44-45

*Special to NPN*

KANSAS CITY, Mo.—Net savings for the 1944-45 fiscal year of Consumers Co-operative Assn. totaled $1,766,507.71, according to the 17th annual report of the association, excerpts of which were published recently in *The Co-operative Consumer*.

| | | |
|---|---|---|
| Consumers Co-operative Assn. | | $ 579,114.31 |
| Co-operative Refinery Assn. | | 1,175,541.28 |
| Co-operative Pipe Line Assn: | | |
| Savings from CPLA operations | $5,787.50 | |
| Savings from COPA operations to May 2, 1945, subsequently transferred to CPLA | 6,064.62 | 11,852.12 |
| Combined Savings | | $1,766,507.71 |

The C.C.A. established new records in volume of business transacted, net savings made and member associations served, the report states. The new volume of merchandise and services furnished to patrons amounted to $26,560.60. The savings increase represents a gain of 15.8% or $240,703.12 while the gain in volume of business amounted to $10,086,349, or 61%.

Referring to its petroleum activities, the report tells of the consolidation of Co-operative Oil Producing Assn. and Co-operative Refinery Assn. activities all under C.R.A. heading. The C.R.A. branch reported the purchase of 68 producing oil wells, the drilling of 10 producers and 7 dry holes and the plugging and selling of 6 old wells. It now has 186 producing wells in Kansas, 73 in Oklahoma, 108 in Illinois and two in Texas, a total of 369.

C.R.A. has 49,762 acres of undeveloped oil leases in Kansas, Oklahoma, Texas, New Mexico, Illinois and Colorado. Total production was set at 1,014,330 bbls. as against a 5,655,647-bbls. consumption by C.C.A. refineries.

Co-operative Pipeline Assn. reported net savings for the year of $11,852, of which $5,787 was from its own operations, the balance being the savings transferred from C.O.P.A. at the time of its consolidation with C.R.A. The pipeline system operated as a department of C.R.A. made net operating savings of $30,773. The system delivered 4,196,662 bbls. of crude to Coffeyville through its 868 miles of line during the year.

Net savings of C.R.A., refining subsidiary of C.C.A., were $1,175,541 for the fiscal year, after $250,000 had been set aside for the refinery obsolescence reserve. Plant No. 1 at Coffeyville showed a net of $1,060,950. This plant was purchased from National Refining Co. early in 1944.

Plant No. 2 at Coffeyville, an aviation gasoline refinery, was built by the federal government at a cost of about $6,500,000. It was leased and operated by C.R.A. The annual report shows that during the fiscal year it produced 20,580,000 gallons of high octane gasoline and made net savings of $214,314. It was stated that a study is being made of the plant facilities with a view toward taking it over.

### Consumers Co-operative Assn.'s Growth in Petroleum

Years Ended August 31

| Year | Refined Cars | Lube Oil Gallons | Greases Pounds |
|---|---|---|---|
| 1929 | 372 | 135,362 | 73,871 |
| 1930 | 1,196 | 319,584 | 189,981 |
| 1931 | 1,766 | 510,881 | 378,268 |
| 1932 | 2,032 | 544,533 | 433,455 |
| 1933 | 2,423 | 596,879 | 450,145 |
| 1934 | 3,211 | 794,540 | 579,757 |
| 1935 | 4,681 | 1,004,662 | 850,201 |
| 1936 | 5,307 | 989,992 | 727,090 |
| 1937* | 4,078 | 769,397 | 1,108,928 |
| 1937-1938 | 6,101 | 1,022,450 | 1,991,155 |
| 1938-1939 | 6,564 | 1,194,371 | 2,162,795 |
| 1939-1940 | 7,803 | 1,210,034 | 2,522,033 |
| 1940-1941 | 10,185 | 1,275,134 | 3,090,768 |
| 1941-1942 | 11,980 | 1,215,959 | 3,635,592 |
| 1942-1943 | 11,457 | 1,263,412 | 3,823,294 |
| 1943-1944 | 15,881 | 10,599,166 | 4,040,591 |
| 1944-1945 | 21,544 | 20,839,456 | 4,577,746 |
| GRAND TOTAL | 115,581 | 44,285,812 | 30,635,670 |

* 8 months.

## CPA Hopes for Rising Output In Cars, Trucks and Tires

NPN News Bureau

WASHINGTON — Production of 54,000 passenger cars and 639,000 trucks in the first 11 months of 1945 fell "far short of earlier forecasts," the Civilian Production Administration reports, but reconversion in most automotive plants is now virtually complete, "and production can be expected to expand rapidly after the settlement of the present labor-management differences."

In its last monthly report for 1945, CPA also predicted steadily rising production of tires, farm machinery, and other items, and said remaining controls over basic materials, including chemicals, rubber, steel, tin, lead, will be reduced "as rapidly as is justified."

Production of automobiles and other consumer and producer items is getting under way slowly, CPA said, not only because of industrial disputes and the problems of reconversion, but also because of shortage of such materials as sheet steel, gears and castings.

Of tires, CPA had this to say:

"There will be adequate supplies of tires to meet all the needs for new truck and passenger car production which the automotive industry can achieve. Overall tire production in the first week of December was running at a rate of 5% to 10% above November with further gains forecast for the next week. November production of 3.7 million passenger car tires was only slightly higher than October, but was more than 40% above September and equivalent to 90% of the prewar rate. Production of one million truck and bus tires in November was down 5% from October but was up 24% from September and was far above prewar production levels."

## Indiana Standard's Hammond Building Program Is Set

*Special to NPN*

HAMMOND, Ind.—Building permits for the erection of eight buildings, including a new $1,500,000 main office building and laboratory, have been issued to the Standard Oil Company (Indiana) by the city building inspector.

The new buildings will be erected on filled-land of Lake Gage where the company recently purchased something over 500 acres and will expand the present Whiting properties of the company.

## FPC Warns Gas Companies

NPN News Bureau

WASHINGTON—The Federal Power Commission has sounded a warning to natural gas companies who ". . . have constructed, and some instances operated, facilities without having received prior authorization required by Section 7 of the Natural Gas Act," and asserted in letter to all natural gas companies subject to its jurisdiction, that "appropriate action" would be taken against such violators.

## January Crude Demand Seen at 4,500,000 B/D

NPN News Bureau

WASHINGTON—Probable crude oil demand of 4,500,000 b/d during January is forecast by the Bureau of Mines in a report which points out that the estimate is higher than had been anticipated earlier due to refinery cutbacks in September and October which have led to a shortage in fuel oil and kerosine supplies.

"Unless the total demand for all oils proves to be materially greater in the first quarter than anticipated," the bureau added, however, "a sharp reduction in the demand for crude oil may occur in February and March. The problem of meeting fuel oil requirements without an excessive season increase in gasoline stocks may cause readjustments in yields and a reduction in runs as soon as fuel oil supplies become adequate."

The bureau's statement continued:

"The reductions in refinery operations in the last half of September and the first half of October have necessitated material readjustments in anticipated crude oil demand in November, December and January. Actual runs to stills in September were reduced to 4,275,000 b/d and to 4,244,000 b/d in October. On the basis of current figures available, total runs appear to have approximated 4,715,000 b/d during November and may average 4,560,000 b/d in December.

"Available data for the last four months of 1945 indicate that the total demand for all oils will approximate forecasts for that period and amount to about 5,000,000 b/d. The net result of refinery operations during this period appears to indicate that some 9 million bbls. in runs, may have to be made up during the first quarter of 1946, or an equivalent of 100,000 b/d."

Following is the bureau estimate of daily crude oil demand by states

| State | Forecast Jan., 1946 | Actual Demand Jan., 1945 |
|---|---|---|
| Texas | 1,950,000 | 2,151,400 |
| California | 832,000 | 889,800 |
| Oklahoma | 382,000 | 376,000 |
| Louisiana | 365,000 | 293,900 |
| Kansas | 260,000 | 257,900 |
| Illinois | 206,000 | 202,000 |
| New Mexico | 98,000 | 101,600 |
| Wyoming | 90,000 | 111,500 |
| Arkansas | 76,000 | 86,100 |
| Mississippi | 48,000 | 40,400 |
| Michigan | 46,000 | 50,000 |
| Pennsylvania | 35,000 | 32,300 |
| Kentucky | 28,500 | 27,700 |
| Montana | 21,000 | 22,200 |
| Colorado | 20,000 | 9,800 |
| Indiana | [illegible] | 15,600 |
| New York | [illegible] | 12,100 |
| West Virginia | [illegible] | 7,100 |
| Ohio | [illegible] | 7,500 |
| Nebraska | [illegible] | 600 |
| Other | [illegible] | 300 |
| Total | 4,500,000 | [illegible],695,800 |

## '46 Looms as a Big Year For the Oil Heat Industry

The year 1946 will be a scrambling, scrapping, fighting year for the oil heat industry, W. A. Matheson, president of the Oil-Heat Institute of America, predicts.

Mr. Matheson's views on this subject for 1946, with a bit of warning to salesmen for 1947, follows:

The year 1946 is logically the foundation or first of the five postwar years during which industrial America looks forward to hitting new, all-time highs. This portends a fulltime job in itself. The year, however, will have an additional load to bear. It must pick up all the unfinished business of 1945. That's another fulltime job. But this will dismay no one. Certainly it will detract nothing from the vigor with which so enthusiastic an industry as oil heating meets the challenge of the New Year.

During the first five postwar years the oil heat industry looks forward to sales of over one billion dollars in equipment alone. Nine hundred million dollars of this will be made by the power burner field, principally domestic. The balance will be made by the space heater or vaporizing burner industry.

An industry with this potential can accept the gigantic 1946 task just ahead with the necessary confidence to overcome production and reconversion problems, secure in the knowledge that the public wants and will have automatic oil heating just as fast as and in as great quantities as it can be built and installed for them.

Originally oil heating equipment production had been expected to reach normal by June, 1946. Delays to date indicate that this time may necessarily be set ahead, possibly to September; perhaps with the traditional seasonal bulge anticipated at that time, to an even later date. It will be a scrambling, scrapping, fighting year with production and the installation of that production the major problem to be solved by the oil heating industry.

Watch out, you salesmen, don't let this condition soften you too much. In 1947 you'll be needing your selling muscles. Don't let them get flabby.

## '46 Outlook for Gas Industry Looks Bright, Assn. Head Says

Commenting on the outlook of the gas industry for 1946, H. Carl Wolf, managing director of the American Gas Assn. says:

"The domestic gas load has continued to grow and every indication is that this growth will be accelerated when new appliances with new features resulting from the intense research program of the industry begin coming off the assembly lines.

"The rapidity with which gas can be applied to industrial processes creates no problem in reconversion and hence, the sale of gas for commercial and industrial purposes will follow closely the tempo of overall general business reconversion.

"The new research program of the gas industry is opening up new uses for both domestic and industrial gas as well as improved methods of manufacturing. The sum total of these developments and tendencies would indicate enlarged uses of gas during the coming year. The effect of this expansion on net earnings will depend in large degree on the ability of the Government to hold in line prices for materials used by the gas companies, since the selling price of the commodity is a practical ceiling."

## Oklahoma Petroleum Motor Transport Assn. Meet Set

NPN News Bureau

TULSA — The annual meeting and election of officers for 1946 of the Petroleum Motor Transport Assn. of Oklahoma was scheduled to be held Jan. 3 at 402 Tulsa Bldg.

Slated for 1946 officers, according to report of nomination committee headed by J. W. Raeburn, Tulsa, Tidewater Associated Oil Co., are: president, J. W. Randle, The Texas Co., Tulsa; first vice president, C. J. Martin, Phillips Petroleum Co., Bartlesville; second vice president, J. M. Green, Olson Drilling Co., Tulsa; and secretary-treasurer, J. L. Avery, Adkin Oil Co., Tulsa. Directors nominated, all of Tulsa, include: Omar Fincannon, Helmerich & Payne, Inc.; R. E. Campbell, Sunray Oil Co., and R. C. Hopper, Skelly Oil Co.

Present officers include: H. S. Newby, president, Bartlesville, Cities Service Oil Co.; Dal Clark, Tulsa, and C. J. Martin, Bartlesville, vice presidents, both of Phillips Petroleum Co., and P. E. Ernst, Bartlesville, secretary-treasurer, Bartlesville.

## W.P.R.A.'s First Postwar Regional Technical Meet Set

NPN News Bureau

TULSA — Western Petroleum Refiners Assn. will hold its first postwar regional technical meeting in the Garrett Hotel, El Dorado, Ark., Jan. 18, according to announcement by J. C. Day, W.P.R.A. secretary

Discussion will follow a paper, "Catalytic Cracking for Medium and Small Refiners," presented by a representative of Universal Oil Products Co, Chicago. Data concerning various types of catalysts, product yields and actual operating costs will be presented in detail before discussion is opened to the floor. Dinner will be served following the meeting.

## Connally Goes to London

NPN News Bureau

WASHINGTON — Anglo-American Oil Treaty hearings have been postponed again by Senate Foreign Relations Committee, this time from Jan. 21 to Feb. 15. Reason is that Chairman Connally and others probably will not be back from London meeting of UNO before that time.

## October Crude Stocks Down 2,696,000 Bbls.

NPN News Bureau

WASHINGTON—October crude stocks at refineries totaled 51,773,000 bbls., down 2,696,000 bbls. from revised September figure, and up 1,450,000 bbls. from the end of October 1944, the Bureau of Mines announced last week.

The bureau also reported October crude runs to stills of 4,244,000 b/d were down 31,000 b/d from the previous month and 392,000 b/d lower than in October, 1944. Daily average imports of foreign crude were up 53,000 b/d from the revised September total and up 57,000 b/d from October, 1944.

Daily average of total domestic receipts declined 223,000 b/d from September. Intrastate movement of crude decreased 192,000 b/d and interstate movement decreased 31,000 b/d. Daily average increases of 10,000, 8,000, 14,000 and 1,000, respectively, were shown in Louisiana, New Mexico, Oklahoma, "other" states. Decreases of 5,000, 13,000 and 46,000 b/d were shown in Illinois, Kansas and Texas.

Daily average deliveries of domestic crude to refineries in October were up 10,000, 32,000, and 9,000 b/d respectively in Illinois, Louisiana and New Mexico. They declined 18,000, 7,000, 120,000 and 105,000 b/d in Kansas, Oklahoma, Texas and California, respectively. Intrastate pipeline movement in October dropped 178,000 b/d from September while interstate pipeline movement decreased 166,000 b/d. Interstate boat movement showed an increase of 129,000 b/d over September.

## Louisiana Allowable Set at 409,214 B/D, up 3079 B/D

*Special to NPN*

BATON ROUGE—Louisiana allowable for January, 1946, has been set at 409,214 b/d, up 3079 b/d from the December figure, according to Joseph L. McHugh, commissioner of conservation. South Louisiana fields have been allocated 326,534 b/d, an increase of 444 over December; North Louisiana is authorized to produce 83,680 b/d, 2635 b/d more than previous month.

## Bahamas Exploration Announced By Standard Oil of Jersey

NPN News Bureau

NEW YORK — Standard Oil Co. Bahamas, Ltd., newly-formed affiliate of Standard Oil Co. (New Jersey), will undertake its first producing venture in the Islands with recent acceptance of acreage allocations made by local government, Jersey Standard announced last week. The company plans to begin initial exploration activities in near future. Heretofore Jersey Standard has conducted only marketing operations in Bahamas.

## Texas Gulf Coast Crude Runs To Stills 76.8% of Capacity

*Special to NPN*

HOUSTON — The Gulf Coast Refiners Assn., reporting on operations of 10 operating Texas Gulf Coast independent refineries for the first half of December, 1945, indicates crude runs to stills totalling 99,053 b/d, which is 76.8% of rated capacity.

Stocks of all grades of gasoline and naphthas increased during the first half of December by 195,182 bbls. and were reported at 1,714,799 bbls. A year ago total gasoline stocks were 1,578,183 bbls.

Aviation gasoline stocks Dec. 15 were 463,193 bbls., indicating a decrease of 12,973 bbls. from 476,166 bbls., reported Dec. 1.

Automotive gasoline stocks considered alone were 849,797 bbls. Dec. 15, showing an increase since Dec. 1 of 167,982 bbls. This indicates continued low inventory of this product. A year ago automotive gasoline stocks were 509,671 bbls.

Stocks of various grades of naphtha increased 40,173 bbls., from 361,636 bbls. Dec. 1 to 401,809 bbls. Dec. 15.

Kerosene stocks at 253,701 bbls. Dec. 15 indicate a decrease of 72,174 bbls. during the period. Diesel gas oil stocks Dec. 15 were 98,937 bbls. reflecting a decrease of 84,858 bbls. Stocks of other grades of gas oil increased 96,798 bbls. to 1,164,476 bbls. during the period. Stocks of No. 5 Fuel oil decreased 10,519 bbls. to 258,642 bbls. and Bunker C fuel oil decreased 52,277 bbls. to 203,458 bbls. Dec. 15.

Total stocks of all products in the plants of the GCRA group were reported at 3,694,013 bbls. Dec. 15, showing an increase of 176,706 bbls. Stocks of all products Dec. 1 were 3,517,307 bbls. A year ago total products stocks were 4,196,110 bbls.

## New Prospecting Licenses

Reuters News Agency

LONDON—Ten more oil prospecting licenses have been granted the D'Arcy Exploration Co. in respect of areas in Britain. The areas are in Buckinghamshire, Hertfordshire, Berkshire, Middlesex, Essex, Hampshire and Su-

## Natural Gasoline Production Shows Gain in October

NPN News Bureau

WASHINGTON — Reporting an 8% increase in October daily average production of natural gasoline and allied products, Bureau of Mines this week announced that the output for the month averaged 12,230,000 gal. per day, up 559,000 gal. from previous month and up 185,000 gal. from Oct. 1944. Major increases were in "other" districts of Texas, Kentucky, W. Virginia, and Louisiana.

Total stocks were reduced 1,080,000 gal. during the month and amounted to 166,280,000 gal. compared with 174,720,000 on Oct. 31, 1944.

Bureau also said that total demand for natural gasoline and allied products was 12 percent above Sept. 1945. Demand for natural and finished gasoline from trade outlets increased 16 percent, liquefied petroleum gases for fuel and chemical uses 23 percent and shipments of light products to refineries 9 percent.

## Drill Wildcat on Barrier Off Coast of North Carolina

NEW YORK — Drilling of a wildcat well on the barrier beach off the North Carolina coast by the Standard Oil Co. of New Jersey has been started, it was announced here last week. Since plans for the operation were announced Oct. 25, the company has reported "considerable progress."

The ultimate objective of the test is to drill to 8500 feet if necessary to reach the limit of oil possibilities. A company statement said even if no show of oil is encountered in the Hatteras test, if the formations are of such character as to indicate the possibility of oil in other locations, incentive will be furnished for further drilling at land locations and in the shallow water areas of Pamlico Sound. Methods already in use along the Gulf Coast and procedure followed by Jersey on Lake Maracaibo, Venezuela, probably could be adapted to these operations.

## Sets Oklahoma Allowable For January at 390,000 B/D

NPN News Bureau

OKLAHOMA CITY—January crude allowable for Oklahoma has been set at 390,000 b/d, by State Corporation Commission, 2000 bbl. above the December allowable. November production averaged 400,200 b/d.

Per well allowable in the West Edmond field was cut from December rate of 138 b/d to 131 b/d for January. Gas oil ratio for the field was increased from 2000 cu. ft. to 3364 cu. ft.

Added to list of prorated pools was Billings West with a per well allowable of 250 b/d. Pool was discovered by Deep Rock. Removed from restricted list was the Jones Northeast pool.

## Market Reports

**MIDWEST** — All markets were very active during the past week. Snow and cold weather throughout created a big demand for kerosine and fuel oil locally, which, plus search for products in this market by eastern buyers, developed a shortage with most fuel oil products selling at ceilings.

A different picture prevails in gasoline as there is an abundant supply at reduced prices. A midwest refiner on Dec. 28, reduced house brand to 5.625c; 63-66 oct. U.S.M. to 5.25c and U.S.M. 60 & below to 4.875c, which are new lows in open spot refiner prices, although marketers have previously sold house brand down to 4.875c.

In central Michigan, a refiner not previously quoting, Dec. 28 established a new low in 100-300 vis. fuel of 4.375c; quoted 44-66 kerosine at 5.75c and No. 2 light straw at 5.25c, which added these two items to the listing of products.

♦ ♦ ♦

**MIDCONTINENT**—New price ranges of 6.125-6.75c on 78-80 oct. Ethyl, 5.375-6c on 73-75 oct., 4.875-5.25c on 60 oct. and below, and flat price of 4.375c on 41-43 w.w. kerosine were affected in Oklahoma market Dec. 26, when two refiners reported lowering gasoline postings and refiner quoting the low of 4.25c on kerosine raised his price. No other price changes were reported.

Gasoline demand continues slow generally, although some pick up was noted in East Texas due to holiday traveling. Heating oil demand has become so heavy several Oklahoma refiners said they were 25-30 cars behind on range oil, and Nos. 1 and 2 fuel oil. Kansas refiner said if weather continues as cold he will have to prorate burning oils to customers in two weeks. Railroads said to be taking most of residual production and wanting more.

Two cars Grade 26-70 natural gasoline were reported sold at 4.5c f.o.b. Group 3. Seven cars were reported sold at 3.5c f.o.b. Breckenridge; seller quoted 3.75c during the week.

♦ ♦ ♦

**CALIFORNIA**—No change in quoted prices noted during the week. Gasoline sales among the independent companies decreased somewhat at the close of the holidays. The independents, however, seem to have made adjustments to the reduced sales by slowing down refinery runs and thus diminishing the large inventories.

♦ ♦ ♦

**PENNSYLVANIA** — New prices were effected in the upper field when a refiner raised his price .425c for kerosine 45 w.w. to 6.55c, making a new range of 6.25-6.55c. He also raised his price on Nos. 2 and 3 fuel oil from 5.875c, making a flat price of 6.25c.

The range of 5.75-5.875c was unchanged when a lower field refiner reduced his price .125c to 5.75c for No. 2 fuel oil. He said that although OPA allowed no increase in his area (Zone 6), he is now able to make a better margin on kerosine shipments into Maryland. He reported sale of 4 cars 36-40 fuel oil for local shipment.

Several inquiries were reported for 45 kerosine at the low of the 6.25c-6.55c range in the upper field. The only refiner quoting the low said he is making open spot sales at that price to regular customers only.

♦ ♦ ♦

**ATLANTIC COAST** — New prices were posted for Nos. 1 and 2 fuel oil at Pensacola when a supplier re-entered the market for No. 2 fuel oil and raised his price ½c for No. 1. Prices are now 4.95 and 5.3c respectively. An East Coast refiner reported transportation difficulties are being felt as 43 tankers last week were tied up. Crews refused to leave port until after the holidays, they said.

Marketers in Boston, Providence and other northern points expressed great concern over the acute shortage of kerosine and light heating oils. There is no relief in the situation since price increase, they said.

The residual supply situation now appears to be as acute as that of the lighter oils. All orders are behind schedule.

♦ ♦ ♦

**GULF COAST** — New price ranges were effected at Gulf points for several refined products when refiners who had not posted new prices for shipment into Dist. 1 raised their quotations. All prices for kerosine and No. 2 fuel oil represent the quotations for ultimate shipment into Dist. 1 and other districts. For example:

Kerosine 41-31 w.w., tank car lots ranges from 4.125-4.75c, the low of the range is for other districts while the price for Dist. 1 shipment is 4.625-4.75c.

All refined products continued very tight with transportation problems mounting.

## Summary of Daily Gasoline Prices (December 21 to December 31)

| U. S. Motor (ASTM octane) | Monday Dec. 31 | Friday Dec. 28 | Thursday Dec. 27 | Wednesday Dec. 26 |
|---|---|---|---|---|
| **78-80 octane Ethyl:** | | | | |
| Oklahoma | 6.125- 6.75 | 6.125- 6.75 | 6.125- 6.75 | 6.125- 6.75 |
| Mid-Western (Group 3 basis) | 6.625- 6.75 | 6.625- 6.75 | 6.625- 6.75 | 6.625- 6.75 |
| N. Tex. (For shpt. to Tex. & N. M. dest'ns.) | 7 | 7 | 7 | 7 |
| W. Tex. (For shpt. to Tex. & N. M. dest'ns.) | 7 - 7.125 | 7 - 7.125 | 7 - 7.125 | 7 - 7.125 |
| E. Tex. (Truck Tnsp.) | 7 | 7 | 7 | 7 |
| **73-75 octane:** | | | | |
| Oklahoma | 5.375- 6 | 5.375- 6 | 5.375- 6 | 5.375- 6 |
| Mid-Western (Group 3 basis) | 5.7 - 6 | 5.7 - 6 | 5.7 - 6 | 5.7 - 6 |
| N. Tex. (For shpt. to Tex. & N. M. dest'ns.) | 6 | 6 | 6 | 6 |
| W. Tex. (For shpt. to Tex. & N. M. dest'ns.) | 6 | 6 | 6 | 6 |
| E. Tex. (Truck Tnsp.) | 6 | 6 | 6 | 6 |
| **63-66 octane:** | | | | |
| Oklahoma | 5.375 (1) | 5.375 (1) | 5.375 (1) | 5.375 (1) |
| Mid-Western (Group 3 basis) | 5.5 (1) | 5.5 (1) | 5.5 (1) | 5.5 (1) |
| N. Tex. (For shpt. to Tex. & N. M. dest'ns.) | 5.625 (1) | 5.625 (1) | 5.625 (1) | 5.625 (1) |
| W. Tex. (For shpt. to Tex. & N. M. dest'ns.) | 5.625 (2) | 5.625 (2) | 5.625 (2) | 5.625 (2) |
| E. Tex. (Truck Tnsp.) | .... | .... | .... | .... |
| **60 octane & below:** | | | | |
| Oklahoma | 4.875- 5.25 | 4.875- 5.25 | 4.875- 5.25 | 4.875- 5.25 |
| Mid-Western (Group 3 basis) | 5.1 - 5.25 | 5.1 - 5.25 | 5.1 - 5.25 | 5.1 - 5.25 |
| N. Tex. (For shpt. to Tex. & N. M. dest'ns.) | 5.2 - 5.25 | 5.2 - 5.25 | 5.2 - 5.25 | 5.2 - 5.25 |
| W. Tex. (For shpt. to Tex. & N. M. dest'ns.) | 5.25 | 5.25 | 5.25 | 5.25 |
| E. Tex. (Truck Tnsp.) | 5.25 | 5.25 | 5.25 | 5.25 |
| **Motor Gasoline, 73-75 oct.** | | | | |
| New York harbor | 8 | 8 | 8 | 8 |
| New York harbor, barges | 7.9 | 7.9 | 7.9 | 7.9 |
| Philadelphia district | 8 | 8 | 8 | 8 |
| Baltimore district | 7.75 | 7.75 | 7.75 | 7.75 |
| **Motor Gasoline, 70-72 oct.** | | | | |
| New York harbor | .... | .... | .... | .... |
| New York harbor barges | .... | .... | .... | .... |
| Philadelphia district | .... | .... | .... | .... |
| Baltimore district | .... | .... | .... | .... |
| **Motor Gasoline:** | | | | |
| **Western Penna. Bradford-Warren:** | | | | |
| (a) "Q" Gasoline, Min. 74 Oct. (ASTM) | 7.50 - 7.75 | 7.50 - 7.75 | 7.50 - 7.75 | 7.50 - 7.75 |
| **Western Penna. Other Districts:** | | | | |
| "Q" Gasoline, Min. 74 Oct. (ASTM) | 7 - 7.25 | 7 - 7.25 | 7 - 7.25 | 7 - 7.25 |
| 70 oct. (ASTM) | .... | .... | .... | .... |

Note: Gasoline prices are as reported in each day's Platt's OILGRAM. Daily Oil Price Service.

# OIL PRICE SECTION

## ★

## At Refineries and Terminals and by Tank Wagon

Prices herewith are reproduced from Platt's *OILGRAM* Daily Oil Price Service, associated with National Petroleum News, whose representatives in all *NPN-OILGRAM* offices devote their time exclusively to reporting oil industry prices everywhere.

Prices shown are actual sales prices, or quotations meaning sellers' general offers or posted prices; for current sales and shipment; for the business day or period stated; except Tank Wagon prices, prices are for bulk lots such as tank car and motor transport; barge or tanker cargo lot prices are identified; FOB refineries or terminals; in cents per gal. except where shown in bbls. of 42 gals.; ex all fees and taxes; for crude oil and its products lawfully produced and transported; reported as received by *OILGRAM* and National Petroleum News but not guaranteed; for subscribers' private use only and not for resale or distribution or publication. For further details of price conditions apply to any *NPN-OILGRAM* office or see back of any *OILGRAM* Price Service invoice.

For complete price service delivered daily from nearest *OILGRAM* publishing office, New York, Cleveland and Tulsa, address Platt's Price Service, Inc., 1213 W. 3rd St., Cleveland (13), Ohio. Annual subscription rate payable in advance $100 per year train mail and $112.50 per year air mail.

## Refinery Prices

### Gasoline —U. S. Motor (A S T M) except where otherwise specified.

| Prices in Effect | Dec. 31 | Dec. 21 |
|---|---|---|
| **OKLAHOMA** | | |
| 78-80 oct. Ethyl. | 6.125– 6.75 | 6.25 – 6.75 |
| 73-75 oct. | 5.375– 6 | 5.5 – 6 |
| 63-66 oct. | 5.375 (1) | 5.375 (1) |
| 60 oct. & below. | 4.875– 5.25 | 5 – 5.25 |
| **MID-WESTERN** (Group 3 basis) | | |
| 78-80 oct. Ethyl | 6.625– 6.75 | 6.625– 6.75 |
| 73-75 oct. | 5.7 – 6 | 5.7 – 6 |
| 63-66 oct. | 5.5 (1) | 5.5 (1) |
| 60 oct. & below. | 5.1 – 5.25 | 5.1 – 5.25 |
| **N. TEX.** (For shpt. to Tex. & N. M. dest'ns.) | | |
| 78-80 oct. Ethyl | 7 | 7 |
| 73-75 oct. | 6 | 6 |
| 63-66 oct. | 5.625 (1) | 5.625 (1) |
| 60 oct. & below. | 5.2 – 5.25 | 5.2 – 5.25 |
| **W. TEX.** (For shpt. to Tex. & N. M. dest'ns.) | | |
| 78-80 oct. Ethyl | 7 – 7.125 | 7 – 7.125 |
| 73-75 oct. | 6 | 6 |
| 63-66 oct. | 5.625 (2) | 5.625 (2) |
| 60 oct. & below. | 5.25 | 5.25 |
| **E. TEX.** (Truck Tnspt.) | | |
| 78-80 oct. | 6.375–7 | 7 |
| 73-75 oct. | 5.625–6 | 6 |
| 63-66 oct. | .... | .... |
| 60 oct. & below. | 5.25 | 5.25 |
| **CENT. W. TEX.** (Prices to truck transports) | | |
| 78-80 oct. | 7 (2) | 7 (2) |
| 73-75 oct. | 6 (2) | 6 (2) |
| 67-69 oct. | .... | .... |
| 60 oct. & below. | 5.25 (2) | 5.25 (2) |
| **KANSAS** (For Kansas destinations only) | | |
| 78-80 oct. Ethyl. | 7.1375–7.3 | 7.1375–7.3 |
| 73-75 oct. | 6.1 – 6.3 | 6.1 – 6.3 |
| 63-66 oct. | 5.8 – 5.9(2) | 5.8 5.9 (2) |
| 60 oct. & below. | 5.4 – 5.5 | 5.4 – 5.5 |
| **ARK.** (For shipment to Ark. & La.) | | |
| 78-80 oct. Ethyl | 7 (1) | 7 (1) |
| 73-75 oct. | 6 (1) | 6 (1) |
| 62 oct. | .... | .... |
| 60 oct. & below, unleaded | 5.25 (1) | 5.25 (1) |
| **WESTERN PENNA.** (Motor gasoline) | | |
| *Bradford-Warren*: | | |
| "Q" Gasoline Min. 74 Oct. (ASTM) | 7.50–7.75 | 7.50 – 7.75 |
| *Other districts*: | | |
| "Q" Gasoline, Min. 74 oct. (ASTM) | 7 –7.25 | 7 – 7.25 |
| 70 oct. (ASTM) | .... | .... |

| Prices in Effect | Dec. 31 | Dec. 21 |
|---|---|---|
| **CENTRAL MICHIGAN** (FOB Central Mich. refinery group basis; for shpt. within Mich. may originate at plants outside Central group.) | | |
| U.S. Motor: (Oct. ASTM): | | |
| 73-75 oct. | 7 – 8.125 | 7 – 8.125 |
| 78-80 oct. | 8.5 – 9.25 | 8.5 – 9.25 |
| Str. run gasoline, excluding Detroit shpt. | 5.25 – 6 | 5.25 –6 |
| **OHIO** (S. O. Ohio quotations for statewide delivery and subject to exceptions for local price disturbances). | | |
| 73-75 oct. | 8.375 | 8.375 |
| **CALIFORNIA** U.S. Motor: | | |
| 80-82 oct. (Ethyl) | 8 – 8.5 | 8 – 8.5 |
| 74-75 oct. | 7 – 7.5 | 7 – 7.5 |

### Kerosine, & Gas Fuel Oils

| | | |
|---|---|---|
| **OKLAHOMA** | | |
| 41-43 grav. w.w. | 4.375 | 4.25 – 4.375 |
| 42-44 grav. w.w. | 4.5 | 4.5 |
| Range oil | 4 | 4 |
| No. 1 p.w. | 3.875 | 3.875 |
| No. 1 straw | 3.75 (1) | 3.75 (1) |
| No. 2 straw | 3.625 | 3.625 |
| No. 3 fuel | 3.5 | 3.5 |
| No. 6 fuel | $0.90–$0.97 | $0.90–$0.97 |
| U. G. I. Gas Oil | .... | .... |
| 14-16 fuel | $0.97 (1) | $0.97 (1) |
| **MID-WESTERN** (Group 3 basis) | | |
| 41-43 grav. w.w. | 4.3 – 4.375 | 4.3 – 4.375 |
| 42-44 grav. w.w. | 4.5 | 4.5 |
| Range Oil | 4 | 4 |
| No. 1 p.w. | 3.875 | 3.875 |
| No. 2 straw | 3.625 | 3.625 |
| No. 3 | 3.5(1) | 3.5 (1) |
| No. 5 | .... | .... |
| No. 6 | $0.97 (1) | $0.97 (1) |
| **N. TEX.** (For shpt. to Tex. & N. M. dest'ns.) | | |
| 41-43 grav. w.w. | 4.375 | 4.375 |
| 42-44 grav. w.w. | 4.5 (1) | 4.5 (1) |
| No. 1 p.w. | 3.875 (1) | 3.875 (1) |
| No. 6 fuel | $0.97 (1) | $0.97 (1) |
| **W. TEX.** | | |
| No. 6 fuel | $0.97 (1) | $0.97 (1) |
| **E. TEX.** (Truck Tnspt.) | | |
| 41-43 grav. w.w. | 4.375 | 4.375 |
| 42-44 grav. w.w. | 4.375–4.5(2) | 4.375–4.5 (2) |
| Range Oil | 3.875–4 (2) | 3.875– 4 (2) |
| No. 1 p.w. | 3.875 (1) | 3.875 (1) |
| 45 Cet. Diesel | 4.25 (1) | 4.25 (1) |
| No. 2 straw | 3.5–3.625 (2) | 3.5–3.625 (2) |
| No. 3 fuel | .... | .... |
| 58 D.I. & above | 4.25 (1) | 4.25 (1) |
| No. 6 fuel | $0.97 | $0.97 |
| U.G.I. gas oil | 3.5 (1) | 3.5 (1) |
| 14-16 grav. | .... | .... |
| **AMARILLO, TEX.** (For shpt. to W. Okla. & Tex. differential territory.) | | |
| 42-44 grav. w.w. | 4.5 (1) | 4.5 (1) |
| **KANSAS** (For Kansas destinations only). | | |
| 41-43 grav. w.w. | No Price | No Price |
| 42-44 grav. w.w. | 4.7 | 4.7 |
| No. 1 p.w. | 4.1 | 4.1 |
| No. 6 fuel | $1.02 | $1.02 |
| **ARK.** (For shipment to Ark. and La.) | | |
| 41-43 grav. w.w. | .... | .... |
| 42-44 w.w. kero | 4.5 (1) | 4.5 (1) |
| No. 1 | .... | .... |
| No. 2 | 3.625 (1) | 3.625 (1) |
| No. 3 fuel | 3.5 (1) | 3.5 (1) |
| Tractor fuel, for shpt. to Ark. points only | 5.125 (1) | 5.125 (1) |
| Diesel fuel 52 & below | 4 (1) | 4 (1) |
| Diesel fuel 58 & above | 4.25 (1) | 4.25 (1) |
| **WESTERN PENNA.** | | |
| *Bradford-Warren*: | | |
| 45 grav. w.w. | 6.25 – 6.55 | 6.125– 6.55 |
| 46 grav. w.w. | .... | .... |
| No. 1 fuel | .... | .... |
| No. 2 " | 6.25 | 5.875 |
| No. 3 " | 6.25 | 5.875 (1) |
| 36-40 gravity | 6.25 (2) | 6.25 (2) |
| *Other districts*: | | |
| 45 grav. w.w. | 6.425 | 6.425 |
| 46 grav. w.w. | .... | .... |
| 47 grav. w.w. | 6.55 (2) | 6.55 (2) |
| No. 1 fuel | 6.175– 6.425 | 6.175– 6.425 |
| No. 2 " | 5.75 – 5.875 | 5.75 – 5.875 |
| No. 3 " | 5.75 – 5.875 | 5.75 – 5.875 |
| 36-40 grav. Pittsburgh dist. prices excluded | 5.75 – 5.875 | 5.75 – 5.875 |

| Prices in Effect | Dec. 31 | Dec. 21 |
|---|---|---|
| **CENTRAL MICHIGAN** (FOB Central Mich. refinery group basis for shpt. within Mich.; shpts. may originate at plants outside Central group.) | | |
| 46-49 gravity w.w. | 5.8 – 6 | 5.8 – 6 |
| P.W. Distillate | 5.5 | 5.5 |
| No. 3 gas, oil, Straw | 5 | 5 |
| U.G.I. gas oil | 4.5 | 4.5 |
| **Fuel Oils** (*Vis. at* 100). | | |
| 300-500 Vis. | 4.14 | 4.14 |
| 100-300 Vis. | 4.5 | 4.5 |
| **OHIO** (S. O. quotations for statewide delivery) | | |
| Kerosine | 7 | 7 |
| **CALIFORNIA** | | |
| 40-43 grav. w.w. | 7(1) | 7(1) |
| *San Joaquin Valley*: | | |
| Heavy fuel | $1.10 (2) | $1.10 (2) |
| Light fuel | $1.20 (1) | $1.20 (1) |
| Diesel fuel | 4 (2) | 4 (2) |
| Stove dist. | 5 (2) | 5 (2) |
| *Los Angeles*: | | |
| Heavy fuel | $1.10 (2) | $1.10 (2) |
| Light fuel | $1.20 (1) | $1.20 (1) |
| Diesel fuel | 3.25 – 4 (2) | 3.25 – 4 (2) |
| Stove dist. | 5 (1) | 5 (1) |
| *San Francisco*: | | |
| Heavy fuel | $1.15 (1) | $1.15 (1) |
| Light fuel | $1.25 (1) | $1.25 (1) |
| Diesel fuel | 4.5 (1) | 4.5 (1) |
| Stove dist. | 5.5 (1) | 5.5 (1) |

NOTE: Al labove heavy fuels meet Pacific specification 400; light fuel, spec. 300; Diesel fuels, spec. 200; and stove distillate, spec. 100.

### Lubricating Oils

| Prices in Effect | Dec. 31 | Dec. 21 |
|---|---|---|
| **WESTERN PENNA.** | | |
| Prices are for sales made, or offers reliably ported, to jobbers & compounders only. | | |
| **Viscous Neutrals**—*No. 3 col. Vis. at 70°F.* | | |
| 200 Vis. (180 at 100°) 420-425 fl. | | |
| 0 p.t. | 38 (1) | 38 (1) |
| 10 p.t. | 37 (1) | 37 (1) |
| 15 p.t. | 36 (1) | 36 (1) |
| 25 p.t. | 28–33 | 28–33 |
| 150 Vis. (143 at 100°) 400-405 fl. | | |
| 0 p.t. | 36 (1) | 36 (1) |
| 10 p.t. | 35 (1) | 35 (1) |
| 15 p.t. | 34 (1) | 34 (1) |
| 25 p.t. | 26–31 | 26–31 |
| NOTE: Limited quantity neutrals available to regular trade. | | |
| **Cylinder Stocks:** | | |
| *Brt. stk.*, 145-155 *vis. at* 210°, 540-550 fl., *No. 3 col.* | | |
| 10 p.t. | 30.5 (1) | 30.5 (1) |
| 15 p.t. | 29.5 (1) | 29.5 (1) |
| 25 p.t. | 25 | 25 |
| 600 S.R. filterable | 15 | 15 |
| 650 S.R. | 15.5 | 15.5 |
| 600 fl. | 16 | 16 |
| 630 fl. | 17 | 17 |
| **MID-CONTINENT** (F. o. b. Tulsa) | | |
| Neutral Oils (*Vis. at* 100° *F. 0 to* 10 *P.P.* | | |
| **Pale Oils:** | | |
| **Vis. Color** | | |
| 60-85—No. 2 | 7.5 | 7.5 |
| 86-110—No. 2 | 7.5 | 7.5 |
| 150—No. 3 | 11 –11.5 | 11 –11.5 |
| 180—No. 3 | 11.5 –15 | 11.5 –15 |
| 200—No. 3 | 12 –15 | 12 –15 |
| 250—No. 3 | 14 –16.5 | 14 –16.5 |
| 280—No. 3 | 15 | 15 |
| 300—No. 3 | 16 (2) | 16(2) |
| **Red Oils:** | | |
| 180—No. 5 | 11.5 (1) | 11.5 (1) |
| 200—No. 5 | 12 (1) | 12 (1) |
| 280—No. 5 | .... | .... |
| 300—No. 5 | 16–17.5 (2) | 16–17.5 (2) |
| **Bright Stock**—*Vis. at* 210° | | |
| 200 Vis. D | 27 (1) | 27 (1) |
| 150-160 Vis. D: | | |
| 0 to 10 p.p. | 23 | 23 |
| 10 to 25 p.p. | 22.5–23 | 22.5–23 |
| 25 to 40 p.p. | 23 (1) | 23 (1) |
| 150-160 Vis. E | 22 (1) | 22 (1) |
| 120 Vis. D: | | |
| 0 to 10 p.p. | 22 (2) | 22 (2) |
| 600 S.R. Dark Green | 8.5 (1) | 8.5 (1) |
| 600 S.R. Olive Green | 10-11 (2) | 10-11 (2) |
| 631 S.R. | .... | .... |
| Black Oil | .... | .... |
| **SOUTH TEXAS** (Neutral Oils) | | |
| **Pale Oils** (*Vis. at* 100°*F.*) | | |
| **Vis. Color** | | |
| 100 No. 1½-2½ | 6.5 | 6.5 |
| 200 No. 2-3 | 8.75 | 8.75 |
| 300 No. 2-3 | 9.25 | 9.25 |
| 500 No. 2½-3½ | 10 | 10 |
| 750 No. 3-4 | 10.25 | 10.25 |
| 1200 No. 3-4 | 10.375 | 10.375 |
| 2000 No. 4 | 10.5 | 10.5 |

(Continued on next page)

NOTE—Parenthetical figures after prices indicate number of companies quoting when less than three companies are quoting.

*NOTICE—Owing to great demand, refiners generally limit quotations to regular customers and refuse bids, though higher, from others. Refiners' prices and sales shown; bids reported in market leads.*

## Refinery Prices—Continued

| Prices in Effect | Dec. 31 | Dec. 21 |
|---|---|---|
| **Red Oils:** | | |
| 100 No. 5-6 | 6.5 (2) | 6.5 (2) |
| 200 No. 5-6 | 8.75 | 8.75 |
| 300 No. 5-6 | 9.25 | 9.25 |
| 500 No. 5-6 | 10 | 10 |
| 750 No. 5-6 | 10.25 | 10.25 |
| 1200 No. 5-6 | 10.375 | 10.375 |
| 2000 No 5-6 | 10.5 | 10.5 |

**CHICAGO** (From Mid-Continent p.l. crude). Neutral oils *vis. at* 100° *F. 0 to* 10 *p.p.*

| **Pale Oils** Vis. Color | | |
|---|---|---|
| 60-85—No. 2 | 9 (1) | 9 (1) |
| 86-110—No. 2 | 9.25 (1) | 9.25 (1) |
| 150—No. 3 | 12.5 (1) | 12.5 (1) |
| 180—No. 3 | 13 (1) | 13 (1) |
| 200—No. 3 | 13 (1) | 13 (1) |
| 250—No. 3 | 14 (1) | 14 (1) |
| **Red Oils:** | | |
| 180—No. 5 | 13 (1) | 13 (1) |
| 200—No. 5 | 13 (1) | 13 (1) |
| 250—No. 5 | 14 (1) | 14 (1) |
| 280—No. 5 | 15 (1) | 15 (1) |
| 300—No. 5 | 15.5 (1) | 15.5 (1) |

**Note:** Viscous oils, 15 to 30 p.p. are quoted 0.5c lower; 60-85 and 86-110 No. 2 non-viscous oils, 15 to 30 p.p., 0.25c lower.

| **Unfiltered Steam Refined** (*Viscosity at* 210°) | | |
|---|---|---|
| 140 | 11.5 (1) | 11.5 (1) |
| 160 | 12.5 (1) | 12.5 (1) |
| 200 | 13.5 (1) | 13.5 (1) |
| **Bright stocks,** 160 *vis. at* 210 *No.* 8 *color:* | | |
| 0 to 10 p.p. | 24 (1) | 24 (1) |
| 15 to 25 p.p. | 23.5 (1) | 23.5 (1) |
| 30 to 40 p.p. | 21.5 (1) | 21.5 (1) |
| E filtered Cyl. Stock | 15.5 (1) | 15.5 (1) |

**Note:** To obtain prices delivered in Chicago add 0.25c per gal.

## Natural Gasoline

(Group 3 & Breckenridge prices are to blenders on freight basis shown below. Shipments may originate in any Mid-Continent manufacturing district.)

| | | |
|---|---|---|
| **FOB GROUP 3** | | |
| Grade 26-70 | 4.5 (Sales) | 4.5 (Sales) |
| **FOB BRECKENRIDGE** | | |
| Grade 26-70 | 3.5 (Sales) | 3.5 (Sales) |
| **CALIFORNIA** (FOB plants in Los Angeles basin) | | |
| 21 pound vapor pressure for blending | 4.75 (1) | 4.75 (1) |

## Naphtha and Solvent

| (*FOB Group* 3) | | |
|---|---|---|
| Stoddard solvent | 6.625 | 6.625 |
| Cleaners' naphtha | 7.125 | 7.125 |
| V.M.&P. naphtha | 7.1 - 7.125 | 7.1 - 7.125 |
| Mineral spirits | 6.1 - 6.125 | 6.1 - 6.125 |
| Rubber solvent | 7.1 - 7.125 | 7.1 - 7.125 |
| Lacquer diluent | 7.375- 8.125 | 7.375- 8.125 |
| Benzol Diluent | 7 875- 8.625 | 7.875- 8.625 |
| **WESTERN PENNA.** *Other Districts:* | | |
| Untreated naphtha | 7-7.725 (2) | 7 -7.725 (2) |
| Stoddard solvent | 7.25 - 7.5 | 7.25 - 7.5 |

**OHIO** (S. O. quotations for statewide delivery:) V.M.&P. naphtha. D.C. naphtha, Varnolene &

| | | |
|---|---|---|
| Sohio solvent | 10 | 10 |
| Rubber solvent | 9 | 9 |
| **E. TEXAS** (Truck Tnspt.) | | |
| Stoddard Solvent | 7 (2) | 7 (2) |

## Wax

**WESTERN PENNA.** (Bbls. C.L.)

| **White Crude Scale:** | | |
|---|---|---|
| 122-124 A.m.p. | 4.25 (2) | 4.25 (2) |
| 124-126 A.m.p. | 4.25 | 4.25 |

**MID-CONTINENT** (C.L. FOB Refinery)

| **Semi-refined:** | | |
|---|---|---|
| 128 AMP min., white, 50 kilo bags | No Price | No Price |
| 132-134 AMP, bbls. | 5.25 (1) | 5.25 (1) |

**CHICAGO** (FOB Chicago district refinery of one refiner, in bags, carloads. Carloads, slabs loose, 0.4c less. Melting points are EMP (ASTM) methods; add 3° to convert into AMP.)

| **Fully refined:** | | |
|---|---|---|
| 122-124 (bags only) | 5.6 | 5.6 |
| 125-127 | 6 | 6 |
| 127-129 | 6.25 | 6.25 |
| 130-132 | 6.55 | 6.55 |
| 132-134 | 6.8 | 6.8 |
| 135-137 | 7.55 | 7.55 |

## Petrolatums

**WESTERN PENNA.** (Bbls., carloads; tank cars, 0.5c per lb. less.)

| | | |
|---|---|---|
| Snow White | 6.125- 7.25 | 6.125- 7.25 |
| Lily White | 5.375- 6.25 | 5.375- 6.25 |
| Cream White | 4.375- 5.5 | 4.375- 5.5 |
| Light Amber | 3.375- 4 | 3.375- 4 |
| Amber | 3.125- 3.75 | 3.125- 3.75 |
| Red | 3 - 3.5 | 3 - 3.5 |

## Tank Wagon Prices

*Commercial or consumer tank car, tank wagon, dealer, and service station prices for gasoline* **do not include taxes;** *they do, however, include inspection fees as shown in general footnote. Gasoline taxes, shown in separate column, include 1.5c federal, and state taxes; also city and county taxes as indicated in footnotes. Kerosine tank wagon prices also do not include taxes; kerosine taxes where levied are indicated in footnotes. Dealer discounts are shown in footnotes. These prices in effect Dec.* 31, 1945 *as posted by principal marketing companies at their headquarters offices, but subject to later correction.*

**Atlantic White Flash** (*Regular Grade*)

| | Commercial T.W. | Dealer T.W. | Gasoline Taxes | Kerosine T.W. |
|---|---|---|---|---|
| Philadelphia, Pa | 9 | 9.5 | 5.5 | 11.25 |
| Pittsburgh | 9.5 | 10 | 5.5 | 11.1 |
| Allentown | 9.5 | 10 | 5.5 | 11.6 |
| Erie | 9.5 | 10 | 5.5 | 11.1 |
| Scranton | 9.5 | 10 | 5.5 | 11.6 |
| Altoona | 9.5 | 10 | 5.5 | 11.6 |
| Emporium | 9.5 | 10 | 5.5 | 11.1 |
| Indiana | 9.5 | 10 | 5.5 | 11.6 |
| Uniontown | 9.5 | 10 | 5.5 | 11.1 |
| Harrisburg | 9.5 | 10 | 5.5 | 11.6 |
| Williamsport | 9.5 | 10 | 5.5 | 11.6 |
| Dover, Del. | ... | 10 | 5.5 | 11.6 |
| Wilmington, Del. | ... | 9.5 | 5.5 | 11.1 |
| Boston, Mass. | ... | 9.7 | 4.5 | .... |
| Springfield, Mass. | ... | 10.6 | 4.5 | .... |
| Worcester, Mass. | ... | 10.3 | 4.5 | .... |
| Fall River, Mass. | ... | 9.8 | 4.5 | .... |
| Hartford, Conn. | ... | 10.4 | 4.5 | .... |
| New Haven, Conn. | ... | 9.8 | 4.5 | .... |
| Providence, R. I. | ... | 9.8 | 4.5 | .... |
| Atlantic City, N. J. | ... | 9.5 | 4.5 | **9.0 |
| Camden, N. J. | ... | 9.5 | 4.5 | **9.0 |
| Trenton, N. J. | ... | 9.5 | 4.5 | **9.0 |
| Annapolis, Md. | ... | 9.85 | 5.5 | **9.8 |
| Baltimore, Md. | ... | 9.25 | 5.5 | **8.8 |
| Hagerstown, Md. | ... | 10.35 | 5.5 | 9.3 |
| Richmond, Va. | ... | 10.05 | 6.5 | 11.3 |
| Wilmington, N. C. | ... | 10.35 | 7.5 | 10.9 |
| Brunswick, Ga. | ... | 9.5 | 7.5 | *10.1 |
| Jacksonville, Fla. | ... | 9.5 | 8.5 | 11.1 |

| | Mineral Spirits T.W.† | V.M.&P. T.W.† |
|---|---|---|
| Philadelphia, Pa. | 11 | 12.5 |
| Lancaster, Pa. | 12 | 13.5 |
| Pittsburgh, Pa. | 12.5 | 13.5 |

| | FUEL OILS—T.W. 1** | 2** | 3** | 5 | 6 |
|---|---|---|---|---|---|
| Phila., Pa. | 9.1 | 7.7 | 7.7 | 5.24 | 4.53 |
| Allentown, Pa. | 9.6 | 8.0 | 8.0 | .... | .... |
| Wilmington, Del. | 9.1 | 7.7 | 7.7 | .... | .... |
| Springfield, Mass. | ... | 8.1 | 8.1 | .... | .... |
| Worcester, Mass. | ... | 8.1 | 8.1 | .... | .... |
| Hartford, Conn. | ... | 7.9 | 7.9 | .... | .... |

*Does not include 1c Georgia kerosine tax.

†Mineral Spirits prices also apply to Stoddard Solvent; V.M.&P. prices also apply to Light Cleaners Naphtha.

Discounts:

Gasoline—to undivided dealers, 0.5c off dealer t.w. except Georgia & Florida dealer t.w. and undivided dealer t.w. prices are same.

Kerosine—Thru Penna. & Delaware, 2c off t.w. price on t.w. deliveries of 25 gals. or more at one time.

**Effective Dec. 20, 1945.

| | Conoco N-tane (3rd Grade) †Tank Wagon | Demand Grade) Wagon | Gasoline Taxes | Kerosine T.W. |
|---|---|---|---|---|
| Denver, Col. | 10 | 9 | 5.5 | 10 |
| Grand Junc., Col. | 12.5 | 11.5 | 5.5 | 12.5 |
| Pueblo, Col. | 9.5 | 8.5 | 5.5 | 9.5 |
| Casper, Wyo. | 11.5 | 10.5 | 5.5 | 12 |
| Cheyenne, Wyo. | 10 | 9 | 5.5 | 9 |
| Billings, Mont. | 12 | 11 | 6.5 | 12.5 |
| Butte, Mont. | 11.5 | 10.5 | 6.5 | 13.5 |
| Great Falls, Mont. | 12 | 11 | 6.5 | 12.5 |
| Helena, Mont. | 12 | 11 | 6.5 | 13 |
| Salt Lake City, Utah | 13.5 | 12.5 | 5.5 | 14.5 |
| Twin Falls, Ida. | 14.5 | 13.5 | 7.5 | 17 |
| Albuquerque, N. M. | 10.5 | 9.5 | *7 | 9.5 |
| Roswell, N. M. | 10 | 9 | *7 | 7 |
| Santa Fe, N. M. | 10.5 | 9.5 | *7.5 | 10 |
| Ft. Smith, Ark. | 9 | 6.25 | 8 | 8 |
| Texarkana, Ark. | 9 | 7.5 | *5.5 | 7 |
| Muskogee, Okla. | 7.75 | 6.75 | 9 | 8 |
| Oklahoma City, Okla. | 8 | 7 | 9 | 8 |
| Tulsa, Okla. | 8 | 7 | 9 | 8 |

*Taxes: In gasoline tax column are included these city taxes—Albuquerque, & Roswell, 0.5c, Santa Fe, 1c. Texas 4c state tax applies within city limits of Texarkana, Ark.

†To consumers & Dealers.

**Humble Motor Fuel** (*Regular Grade*)

| | Thriftane Humble *Tank Wagon | Retail | (*Third Grade*) Thriftane *Tank Wagon | Retail | Gasoline Taxes |
|---|---|---|---|---|---|
| Dallas, Tex. | *7.5 | 10.5 | *6.5 | 8.5 | 5.5 |
| Ft. Worth, Tex. | *7.5 | 10.5 | *6.5 | 8.5 | 5.5 |
| Houston, Tex. | 8.5 | 12.5 | 7.5 | 10.5 | 5.5 |
| San Ant., Tex. | 8.5 | 12.5 | 7.5 | 10.5 | 5.5 |

*Consumer tankwagon prices 1c per gallon above dealer tankwagon prices on Humble Gasoline, and Thriftane.

| | Kerosine *Tank Wagon | Retail |
|---|---|---|
| Dallas, Tex. | 7 | 10 |
| Ft. Worth, Tex. | 7 | 11 |
| Houston, Tex. | 8 | 11 |
| San Antonio, Tex. | 7 | 10 |

*To all classes of dealers & consumers.

## Canada

**PRICES OF IMPERIAL OIL, LTD.**

Per Imperial Gallon, which is 1.2 U. S. Gallons

**3-Star Imperial Gasoline** (*Regular Grade*)

| | †Gasoline T.W. | *Gasoline Taxes | Kerosine T.W. |
|---|---|---|---|
| Hamilton, Ont. | 16.5 | 11 | 18 |
| Toronto, Ont. | 16.5 | 11 | 18 |
| Brandon, Man. | 20.5 | 10 | 22.5 |
| Winnipeg, Man. | 20.0 | 10 | 22 |
| Regina, Sask. | 17.5 | 11 | 19.5 |
| Saskatoon, Sask. | 20.3 | 11 | 22.3 |
| Edmonton, Alta. | 18.4 | 10 | 20.4 |
| Calgary, Alta. | 15.5 | 10 | 17.5 |
| Vancouver, B. C. | 15 | 10 | 24 |
| Montreal, Que. | 16.5 | 11 | 17.5 |
| St. John, N. B. | 16 | 13 | 19 |
| Halifax, N. S. | 16 | 13 | 19 |

*Includes 3c Federal, and Provincial taxes.

†To divided & undivided dealers.

**Socony Mobilgas** (*Regular Grade*)

| | Com. Cons. T.W. | Undiv. Dlr. T.W. | Gasoline Taxes |
|---|---|---|---|
| New York City | | | |
| Manhattan & Bronx | 8.9 | 9.4 | *5.5 |
| Kings & Queens | 8.9 | 9.4 | *5.5 |
| Richmond | 8.5 | 9.0 | *5.5 |
| Albany, N. Y. | 8.7 | 9.2 | 5.5 |
| Binghamton, N. Y. | 9.8 | 10.3 | 5.5 |
| Buffalo | 9.0 | 9.5 | 5.5 |
| Jamestown, N. Y. | 9.2 | 9.7 | 5.5 |
| Mt. Vernon, N. Y. | 8.9 | 9.4 | 5.5 |
| Plattsburg, N. Y. | 9.8 | 10.3 | 5.5 |
| Rochester, N. Y. | 9.6 | 10.1 | 5.5 |
| Syracuse, N. Y. | 9.3 | 9.8 | 5.5 |
| Bridgeport, Conn. | 8.8 | 9.3 | 4.5 |
| Danbury, Conn. | 9.3 | 9.8 | 4.5 |
| Hartford, Conn. | 9.4 | 9.9 | 4.5 |
| New Haven, Conn. | 8.8 | 9.3 | 4.5 |
| Bangor, Me. | 9.5 | 10.0 | 5.5 |
| Portland, Me. | 9.1 | 9.6 | 5.5 |
| Boston, Mass. | 8.7 | 9.2 | 4.5 |
| Concord, N. H. | 10.2 | 10.7 | 5.5 |
| Lancaster, N. H. | 10.8 | 11.3 | 5.5 |
| Manchester, N. H. | 10.1 | 10.6 | 5.5 |
| Providence, R. I. | 8.8 | 9.3 | 4.5 |
| Burlington, Vt. | 9.7 | 10.2 | 5.5 |
| Rutland, Vt. | 9.8 | 10.3 | 5.5 |

| | Mineral Spirits | V.M.&P. |
|---|---|---|
| Buffalo, N. Y. | 10.9 | 12.1 |
| New York City | 11 | 12 |
| Rochester, N. Y. | 11.8 | 13.1 |
| Syracuse, N. Y. | 12.2 | .... |
| Boston, Mass. | 12 | 13 |
| Bridgeport, Conn. | †16.3 | †17.3 |
| Hartford, Conn. | †16.3 | †17.3 |
| Providence, R. I. | 13 | 14 |

| | Kerosine Yard | T.W. | Mobilfuel Diesel T.C. | T.W. | Mobilheat Fuel Yard | T.W. |
|---|---|---|---|---|---|---|
| New York: | | | | | | |
| Manhat'n & Bronx | 6.0 | 8.8 | .... | 7.8 | 5.6 | 7.5 |
| Kings & Queens | 6.0 | 8.8 | .... | 7.8 | 5.6 | 7.5 |
| Richmond | 6.0 | 8.8 | .... | .... | 5.6 | 7.5 |
| Albany | 6.0 | 8.3 | 5.3 | 7.8 | 5.5 | 7.5 |
| Binghamton | 7.4 | 9.7 | .... | 9.2 | 6.9 | 8.7 |
| Buffalo | 7.1 | 9.4 | 6.5 | 8.8 | 6.7 | 8.5 |
| Jamestown | 7.2 | 9.5 | .... | 9.1 | 6.8 | 8.5 |
| Mt. Vernon | 6.1 | 8.8 | .... | 7.9 | 5.7 | 7.5 |
| Plattsburg | 6.6 | 8.9 | .... | 8.4 | 6.1 | 7.9 |
| Rochester | 7.2 | 9.5 | 6.4 | 8.7 | 6.4 | 8.2 |
| Syracuse | 7.0 | 9.3 | 6.3 | 8.6 | 6.3 | 8.1 |
| Conn.: | | | | | | |
| Bridgeport | 6.3 | 8.8 | .... | 8.0 | 5.8 | 7.5 |
| Danbury | 6.7 | 9.3 | .... | .... | 6.3 | 7.0 |
| Hartford | 6.5 | 9.0 | .... | 8.0 | 5.9 | 7.7 |
| New Haven | 5.8 | 8.8 | 5.5 | 7.8 | 5.4 | 7.5 |
| Maine: | | | | | | |
| Bangor | 6.4 | 8.8 | 5.9 | 8.2 | 5.9 | 7.6 |
| Portland | 6.0 | 8.7 | 5.3 | 7.8 | 5.5 | 7.5 |

(Continued on next page)

## Tank Wagon Prices—Continued

| | Kero-sine | | Mobil-fuel Diesel | | Mobil-heat Fuel | |
|---|---|---|---|---|---|---|
| | Yard | T.W. | T.C. | T.W. | Yard | T.W. |
| **Mass.:** | | | | | | |
| Boston.... | 6.3 | 9.1 | 5.3 | 7.8 | 5.7 | 7.6 |
| **N. H.:** | | | | | | |
| Concord.. | 6.9 | 9.2 | .... | 9.1 | 6.8 | 8.6 |
| Lancaster. | 8.0 | 10.3 | .... | 10.0 | 7.7 | 9.5 |
| Manchester | 7.0 | 9.6 | .... | 8.8 | 6.5 | 8.3 |
| **R. I.:** | | | | | | |
| Providence. | 6.3 | 8.8 | 5.3 | 7.8 | 5.7 | 7.6 |
| **Vermont:** | | | | | | |
| Burlington. | 6.6 | 8.9 | 6.0 | 8.3 | 6.0 | 7.7 |
| Rutland... | 6.8 | 9.1 | .... | 8.5 | 6.2 | 8.0 |

*Does not include 1% city sales tax applicable to price of gasoline (ex tax).

†In steel barrels.

Discounts: Diesel—On t.w. deliveries, 0.5c for at least 400 gals.; 1c for full tank truck.

### S. O. CAL.

| | *Chevron Supreme Reg. T.T. | Flight 3rd Grade T.T. | Chev-ron Av. 73 T.T. | Gaso-line Taxes | Kero-sine T.T. |
|---|---|---|---|---|---|
| San Francisco, Cal..... | 10 | 9 | 12.5 | 4.5 | 11.5 |
| Los Angeles, Cal..... | 9.5 | 8.5 | 12 | 4.5 | 10 |
| Fresno, Cal... | 11 | 10 | 13.5 | 4.5 | 12.5 |
| Phoenix, Ariz. | 12 | 10 | 14.5 | 6.5 | 12.5 |
| Reno, Nev... | 12 | 11 | 14.5 | 5.5 | 13.5 |
| Portland, Ore. | 10.5 | 9.5 | 13 | 6.5 | 13.5 |
| Seattle, Wash. | 10.5 | 9.5 | 13 | 6.5 | 13.5 |
| Spokane, Wash. | 12.5 | 11.5 | 16 | 6.5 | 16.5 |
| Tacoma, Wash. | 10.5 | 9.5 | 13 | 6.5 | 13.5 |
| Boise, Ida.... | 13.5 | 12.5 | 18 | 7.5 | 16.5 |

Resale and Commercial Gasoline: Tank car deliveries of Chevron Aviation 73, Chevron Supreme and Flight Gasoline .25c per gal. below posted net tank truck price. Tank car deliveries of Chevron Gasoline .375c per gal. below posted net tank truck price. Pearl Oil (The Standard Kerosene) Tank car deliveries 3c below posted tank truck price.

*Standard Supreme changed to Chevron Supreme.

### S. O. IND.

Red Crown (*Regular Grade*)
Blue Crown (*Third Grade*)
Red Dealer Prices

| | Crown Cons. T.W. | Red Crown | Blue Crown | Gaso-line Taxes | Kero-sine T.W. |
|---|---|---|---|---|---|
| Chicago, Ill..... | 11.6 | 9.6 | 9.1 | 4.5 | 10.6 |
| Decatur, Ill..... | 11.6 | 9.6 | 8.7 | 4.5 | 10.3 |
| Joliet, Ill..... | 11.9 | 10.3 | 9.2 | 4.5 | 10.6 |
| Peoria, Ill..... | 11.7 | 9.9 | 9.7 | 4.5 | 10.4 |
| Indianapolis, Ind. | 11.6 | 10.1 | 9.6 | 5.5 | 10.1 |
| Evansville, Ind.. | 11.4 | 9.9 | 8.6 | 5.5 | 9.9 |
| South Bend, Ind. | 12 | 10.5 | 10 | 5.5 | 10.5 |
| Detroit, Mich.... | 11.4 | 9.9 | ... | 4.5 | 10.0 |
| Grand Rapids, Mich..... | 11.4 | 9.9 | ... | 4.5 | 9.9 |
| Saginaw, Mich... | 11.4 | 9.9 | ... | 4.5 | 9.9 |
| Green Bay, Wis.. | 12.2 | 10.7 | 10.2 | 5.5 | 10.9 |
| Milwaukee, Wis.. | 12.1 | 10.6 | 10.1 | 5.5 | 10.8 |
| La Crosse, Wis... | 11.9 | 10.4 | 9.9 | 5.5 | 10.6 |
| Minneapolis - St. Paul..... | 11.9 | 10.4 | 9.9 | 5.5 | 10.6 |
| Duluth, Minn... | 12.2 | 10.7 | .... | 5.5 | 10.9 |
| Mankato, Minn.. | 11.9 | 10.4 | 9.9 | 5.5 | 10.6 |
| Des Moines, Ia.. | 11.4 | 9.9 | 9.4 | 5.5 | 10.1 |
| Mason City, Ia.. | 11.7 | 10.2 | 9.7 | 5.5 | *10.4 |
| St. Louis, Mo.... | 11.0 | 9.5 | 9.3 | *4.5 | 10.1 |
| Kansas City, Mo. | 11.0 | 9.5 | 8.6 | *4.5 | 9.7 |
| St. Joseph, Mo.. | 11.2 | 9.7 | .... | *4.5 | 9.9 |
| Fargo, N. D..... | 12.9 | 11.4 | 10.9 | 5.5 | 11.6 |
| Huron, S. D..... | 12.3 | 10.8 | 10.3 | 5.5 | 11.0 |
| Wichita, Kans... | 9.5 | 8.8 | 7.2 | 4.5 | 9.0 |
| Omaha, Neb.... | 11.4 | 9.6 | 9.4 | 6.5 | 10.1 |

**Stanavo Ethyl Aviation Number 73**

| | Cons. T. W. | *Taxes |
|---|---|---|
| Detroit, Mich..... | 16.0 | 4.5 |
| Fargo, N. D..... | 15.4 | 5.5 |
| Huron, S. D..... | 14.8 | 5.5 |
| Indianapolis, Ind..... | 14.5 | 5.5 |
| Kansas City, Mo.... | 13.5 | 4.5 |

| | Oleum Spirits | V.M.&P. Naphtha | Stani-sol | *Taxes |
|---|---|---|---|---|
| | (Prices are base prices before discounts) | | | |
| Chicago..... | 13.5 | 13.8 | 12.8 | 4.5 |
| Detroit..... | 15.8 | 15 | 16.3 | 4.5 |
| K. C., Mo.... | 13.3 | 14.3 | 13.8 | 1.5 |
| St. Louis, Mo. | 13.7 | 14.7 | 13.2 | 1.5 |
| Milwaukee... | 14.4 | 15.4 | 14.9 | 5.5 |
| Minnep'ls.... | 14.2 | 15.2 | 13.5 | 5.5 |

**Fuel Oils T.W. Chicago**

| | Standard Heater Oil | Stanolex Furnace Oil |
|---|---|---|
| 1-99 gals..... | 9.3 | 8.8 |
| 100-149 gals..... | 8.3 | 7.8 |
| 150 gals. & over..... | 7.8 | ... |
| 150-399 gals..... | ... | 7.8 |
| 400 gals. & over..... | ... | 7.3 |

| | Stanolex Fuel A | Stanolex Fuel C |
|---|---|---|
| 1-749 gals..... | 6.5 | 5.7 |
| 750 gals. & over..... | 5.75 | 4.95 |

**Stanolex Furnace Oil**

| Other Points | 1-99 gals. | 100 gals. & over |
|---|---|---|
| Indianapolis..... | 9.0 | 8.0 |
| Detroit..... | 8.7 | 7.7 |
| Milwaukee..... | 9.0 | 8.0 |
| Minneapolis..... | 9.1 | 8.1 |
| St. Louis..... | 8.4 | 7.4 |
| Kansas City..... | 8.1 | 7.1 |

*Taxes: In gasoline tax column are included these city taxes—Kansas City, St. Joseph and St. Louis, 1c. Iowa kerosine prices are ex 4c state tax. In naphtha tax column are included 1.5c federal tax and state taxes.

State sales, occupation, consumer and use taxes to be added when applicable.

Effective Dec. 21, 1945

**Crown Gasoline (*Regular*)**

### S. O. KY.

| | †Crown-Gaso-line | Gaso-line Taxes | Kero-sine T.W. |
|---|---|---|---|
| Covington, Ky.... | 9.5 | 6.5 | 9.3 |
| Lexington, Ky.... | 10.5 | 6.5 | 9.3 |
| Louisville, Ky.... | 10 | 6.5 | 8.8 |
| Paducah, Ky..... | 10 | 6.5 | 8.8 |
| Jackson, Miss.... | 10 | 7.5 | *9.0 |
| Vicksburg, Miss... | 9.5 | 7.5 | *8.5 |
| Birmingham, Ala.. | 10 | *8.5 | 9.0 |
| Mobile, Ala..... | 9 | *9.5 | 8.5 |
| Montgomery, Ala. | 10 | *9.5 | *10.0 |
| Atlanta, Ga..... | 10.5 | 7.5 | *10.6 |
| Augusta, Ga..... | 10.5 | 7.5 | *10.1 |
| Macon, Ga..... | 10.5 | 7.5 | *10.6 |
| Savannah, Ga.... | 9.5 | 7.5 | *9.6 |
| Jacksonville, Fla.. | 9.5 | 8.5 | 8.6 |
| Miami, Fla..... | 9.5 | 8.5 | 8.6 |
| Pensacola, Fla.... | 9 | *9.5 | 8.0 |
| Tampa, Fla..... | 9.5 | 8.5 | 8.6 |

**NOTICE**

These prices include inspection fee on both gasoline and kerosine unless otherwise specified per gallon as follows: Ala. 1/40c on gasoline: Florida 1/8c.

Kerosine inspection fee only: Ala. 1/2c.

### S. O. N. J.

Esso (*Regular Grade*)

| | Consumer Tank Wagon | Dealer T.W. | Gaso-line Taxes | Kero-sine T.W. |
|---|---|---|---|---|
| Atlantic City, N. J.. | 9.0 | 9.5 | 4.5 | 8.5 |
| Newark..... | 9.0 | 9.5 | 4.5 | 8.5 |
| Annapolis, Md..... | 9.35 | 9.85 | 5.5 | ... |
| Baltimore..... | 8.75 | 9.25 | 5.5 | 9.3 |
| Cumberland..... | 10.15 | 10.65 | 5.5 | 10.8 |
| Washington, D. C... | 9.0 | 9.5 | 4.5 | 9.8 |
| Danville, Va..... | 10.45 | 10.95 | 6.5 | 9.2* |
| Petersburg..... | 9.55 | 10.05 | 6.5 | 8.8* |
| Norfolk..... | 9.25 | 9.75 | 6.5 | 8.5* |
| Richmond..... | 9.55 | 10.05 | 6.5 | 8.8* |
| Roanoke..... | 10.75 | 11.25 | 6.5 | 9.5* |
| Charleston, W. Va... | 11.05 | 11.55 | 6.5 | 11.1 |
| Parkersburg..... | 10.35 | 10.85 | 6.5 | 10.8 |
| Wheeling..... | 10.35 | 10.85 | 6.5 | 11.4 |
| Charlotte, N. C..... | 10.9 | 11.4 | 7.5 | 9.1 |
| Hickory..... | 11.45 | 11.95 | 7.5 | 10.1 |
| Mt. Airy..... | 11.3 | 11.8 | 7.5 | 9.3 |
| Raleigh..... | 10.65 | 11.15 | 7.5 | 10.1 |
| Salisbury..... | 10.95 | 11.45 | 7.5 | 10.5 |
| Charleston, S. C.... | 9.75 | 10.25 | 7.5 | .... |
| Columbia..... | 10.6 | 11.1 | 7.5 | .... |
| Spartanburg..... | 11.3 | 11.8 | 7.5 | .... |
| New Orleans, La..... | 8.75 | 9.25 | 8.5 | **8.0 |
| Baton Rouge..... | 8.75 | 9.25 | 8.5 | **8.5 |
| Alexandria..... | 8.75 | 9.25 | 8.5 | **8.5 |
| Lake Charles..... | 9.0 | 9.5 | 8.5 | **10.0 |
| Shreveport..... | 8.5 | 9.0 | 8.5 | **7.0 |
| Knoxville, Tenn..... | 10.5 | 11.0 | 8.5 | 10.5 |
| Memphis..... | 8.9 | 9.4 | 8.5 | 8.5• |
| Chattanooga..... | 10.5 | 11.0 | 8.5 | 9.0 |
| Nashville..... | 10.5 | 11.0 | 8.5 | 8.0 |
| Bristol..... | 9.75 | 10.25 | 8.5 | 10.0 |
| Little Rock, Ark..... | 9.5 | 10.0 | 8.0 | 10.0 |
| New Iberia, La..... | 9 | 9.5 | 8.5 | **8 |

| | Mineral Spirits T.W. | V.M.&P. T.W. |
|---|---|---|
| Newark, N. J..... | 13 | 14.5 |
| Baltimore, Md.... | 15.5 | .... |
| Washington, D. C. | 15.5 | .... |

| Fuel Oils—T.W. | No. 1 | No. 2 |
|---|---|---|
| Atlantic City, N. J..... | 8.5 | 7.5 |
| Newark..... | 8.5 | 7.5 |
| Baltimore, Md..... | 8.3 | 7.5 |
| Washington, D. C..... | 8.8 | 7.9 |
| Norfolk, Va..... | 8.5 | 7.3 |
| Petersburg..... | 8.8 | 7.5 |
| Richmond..... | 8.8 | 7.5 |
| Charlotte, N. C..... | 9.1 | 8.9 |
| Hickory..... | ... | 8.5 |
| Raleigh..... | 10.1 | 8.6 |
| Charleston, S. C..... | ... | 7.5 |
| Columbia..... | ... | 8.5 |
| Spartanburg..... | ... | 9.3 |

Discounts:

**Includes 1.0c per gallon State Tax.

*Esso gasoline*—to undivided dealers, 0.5c off dealer t.w.

*Kerosine*—1c off t.w. price for 25 gals. or more, under contract thru territory (Baltimore city contract not necessary) except no discount in state of New Jersey, Virginia, Tennessee and Louisiana.

*Naphtha*—To buyers taking following quantities at one time: Newark, 2c per gal. on 200 gals. or more, less than 200 gals. 0.5c higher price; Baltimore, 2c off on 25 to 100 gals. and 3c on over 100 gals.; Washington, 2c off to contract buyers.

### Notice

These prices include inspection fees on both gasoline and kerosine unless otherwise specified per gallon as follows:

Ala. 1/40c on gasoline; Ark. 1/20c; Fl. 1/8c; Ill. 3/100c; Ind. 1/5c in lots of 25 bbls. or less, 2/25c in lots of more than 25 bbls.; Kans. 1/50c; La. 1/32c; Minn. 7/200c; Miss. 1/50c; Neb. 3/100c; Nev. 1/20c; N. C. 1/4c; N. Da. 1/20c; Okla. 2/25c; S. Car. 1/8c; S. Da. 1/20c; Tenn. 2/5c; and Wisc. 3/100c.

Kerosine inspection fees only: Ala. 1/2c; Fla. 1/8c; Iowa 3/50c; Mich. 1/5c per gal.

•Effective May 1, 1945.

### S. O. OHIO

*Sohio X-70 Gasoline (*Regular Grade*)

| | Con-sumer T.W. | **Re-sel-lers | °S.S. | Gaso-line Taxes | †Kero-sine T.W. |
|---|---|---|---|---|---|
| Ohio, Statewide.. | 12 | 10 | 13.5 | 5.5 | 9.3 |
| Akron..... | 12 | 9.5 | 12.5 | 5.5 | 9.3 |
| Canton..... | 12 | 9.5 | 12.5 | 5.5 | 9.3 |
| Cincinnati..... | 12 | 9.5 | 12.5 | 5.5 | 9.3 |
| Cleveland..... | 12 | 9.5 | 12.5 | 5.5 | 9.3 |
| Columbus..... | 12 | 9.5 | 12.5 | 5.5 | 9.3 |
| Dayton..... | 12 | 9.5 | 12.5 | 5.5 | 9.3 |
| Lima..... | 12 | 9.5 | 12.5 | 5.5 | 9.3 |
| Mansfield..... | 12 | 9.5 | 12.5 | 5.5 | 9.3 |
| Marion..... | 12 | 9.0 | 12.0 | 5.5 | 9.3 |
| Portsmouth..... | 12 | 9.5 | 12.5 | 5.5 | 9.3 |
| Toledo..... | 12 | 9.5 | 12.5 | 5.5 | 9.3 |
| Youngstown..... | 12 | 9.5 | 12.5 | 5.5 | 9.3 |
| Zanesville..... | 12 | 9.5 | 12.5 | 5.5 | 9.3 |

**Aviation Gasoline—Statewide**

| | Consumer Gasoline T.W. | Taxes |
|---|---|---|
| Sohio Aviation Gasoline Clear Spec. AN-F-22, Amend. 1 | 14.5 | 5.5 |
| Esso Ethyl Avia. Grade 73.. | 15.5 | 5.5 |
| Esso (Clear) Avia. Grade 80 | 16.5 | 5.5 |
| Esso Aviation Grade 91/98. | 17.5 | 5.5 |
| Esso Aviation Grade 100/130 | 20.5 | 5.5 |

| | Naphtha—T.W. Statewide | Lucas County |
|---|---|---|
| S. R. Solvent..... | 13.5 | 13.5 |
| D. C. Naphtha... | 14.5 | 14.25 |
| V.M.&P. Naphtha | 14.5 | 14.25 |
| Varnolene..... | 14.5 | 14.25 |
| Sohio Solvent..... | 14.5 | 14.25 |

| Fuel Oils—T.W. | No. 1 | No. 2 | No. 3 | No. 6 |
|---|---|---|---|---|
| Ohio, Statewide ..... | •8.3 | •8.3 | •7.8 | •7.55 |

*Renown (third-grade) prices are same as X-70 unless otherwise noted.

**Except authorized agents.

°Prices at company-operated stations.

††Statewide prices are subject to exceptions other than those shown.

Discounts:

Esso aviation—on contract to hangar operators and resellers. 2c off consumer t.w.

*For Cleveland area only. Full compartment hose dumps.

Fuel oils—Statewide prices are for t.w. & drum deliveries of 50 gals. or more; prices for deliveries of less than 50 gals. are 0.5c higher.

Naphthas—to contract consumers off t.w. prices—Statewide: 300 to 999 gals., 0.5c; 1000 to 2499 gals., 0.75c; 2500 to 4999 gals., 1c; 5000 or more gals., 1.5c. Lucas County: Less than 50 gals., tank wagon price, 50 to 249 gals., 0.5c; 250 to 499 gals., 1c; 500 gals. or over, 1.5c.

### TEXAS CO.

| | Gasoline—Dealer T.W. Fire-Chief (*Regular*) | Indian (*3rd Grade*) | Gaso-line Taxes |
|---|---|---|---|
| Dallas, Tex..... | 7.5 | 6.5 | 5.5 |
| Ft. Worth, Tex.. | 7.5 | 6.5 | 5.5 |
| Wichita Falls, Tex. | 8.5 | 7.5 | 5.5 |
| Amarillo, Tex.... | 8.5 | 7.5 | 5.5 |
| Tyler, Tex..... | 8.5 | 7.5 | 5.5 |
| El Paso, Tex.... | 11 | 10.5 | 5.5 |
| San Angelo, Tex.. | 8.5 | 7.5 | 5.5 |
| Waco, Tex..... | 8.5* | 7* | 5.5 |
| Austin, Tex..... | 8.5 | 7.5 | 5.5 |
| Houston, Tex.... | 8.5 | 7.5 | 5.5 |
| San Antonio, Tex. | 8.5 | 7.5 | 5.5 |
| Port Arthur, Tex. | 8.5 | 7.5 | 5.5 |

*Less 1c temporary allowance to all dealers.

# Atlantic Coast

**Seaboard Export Coastwise Prices**

**(Prices are of refiners, FOB their refineries and their tanker terminals, and of tanker terminal operators FOB their terminals)—Prices in Effect Dec. 31.**

| | MOTOR GASOLINE | | KEROSINE &/OR | FUEL OILS | | | |
|---|---|---|---|---|---|---|---|
| District | 70-72 Oct. (ASTM) | 73-75 Oct. (ASTM) | NO. 1 FUEL | NO. 2 FUEL | NO. 3 FUEL | No. 5 | No. 6 |
| N. Y. Harb. | .... | 8 | 6.1 | 5.4 | 5.4 (1) | $1.59-1.69 (a) | $1.51 |
| N. Y. Harb., barges | .... | 7.9 | 6 | 5.3 | 5.3 (1) | .... | .... |
| Albany | .... | 8.1 | 6.3 | 5.5 | 5.5 (1) | .... | $1.71 (1) |
| Philadelphia | .... | 8 | 6.2 | 5.4 | 5.4 | $1.72 | $1.51 |
| Baltimore | .... | 7.75 | 6.2 | 5.4 | 5.4 (2) | $1.59 (1) | $1.51 (2) |
| Norfolk | .... | 7.5 | 6.1 | 5.4 | .... | $1.55 (1) | $1.47 |
| Wilmington, N. C. | .... | 7.5 | 6.05 | 5.4 | .... | .... | .... |
| Charleston | .... | 7.5 | 6.2 | 5.4 | .... | $1.50 (1) | $1.42 (2) |
| Savannah | .... | 7.37 – 7.375 | 6.05 | 4.95 (2) | 4.95 (1) | .... | $1.42 (1) |
| Jacksonville | .... | 7.37 – 7.375 | 6.05 | 4.95 | .... | .... | $1.42 |
| Miami | .... | 7.37 – 7.375 | 6.05 | 4.95 (2) | .... | .... | .... |
| Tampa | .... | 7.37 – 7.375 | 6.05 | 4.95 | .... | .... | $1.32 |
| Pensacola | .... | 7 (2) | 5.3 | 4.95 | .... | .... | .... |
| Mobile | .... | 6.75 – 6.87 | 4.75 | .... | .... | .... | .... |
| New Orleans | .... | 6.25 | 4.125– 4.75 | 3.75 – 3.95 | .... | $1.05 (1) | $0.97 |
| Portland | .... | 8.3 | 6.3 | 5.5 | 5.5 (1) | .... | $1.555 |
| Boston | .... | 8.2 | 6.2 | 5.5 | 5.5 (1) | $1.735(2) | $1.555 |
| Providence | .... | 8.2 | 6.2 | 5.5 | 5.5 (1) | $1.635 | $1.525 |
| New Haven | .... | .... | .... | .... | .... | .... | $1.525 |

(a) $1.59 semi-refined.

| | Bunker C Fuel Ships' bunkers (Ex Lighterage) | Diesel Oil Ships' bunkers (Ex Lighterage) | Diesel Oil Shore Plants | Gas House Gas Oil 28-34 Gravity |
|---|---|---|---|---|
| New Haven | $1.525 (1) | .... | .... | .... |
| N. Y. Harbor | $1.51 | $2.15 | 5.2 | 5.3 (2) |
| Albany | $1.71 (1) | $2.31 (1) | 5.3 (1) | 5.5 (1) |
| Philadelphia | $1.51 | $2.15 | .... | .... |
| Baltimore | $1.51 (2) | $2.15 (2) | 5.2 (1) | .... |
| Norfolk | $1.47 | $2.15 (2) | 5.2 (1) | .... |
| Charleston | $1.42 (2) | $2.15 (2) | 5.2 (1) | .... |
| Savannah | $1.42 (1) | .... | .... | .... |
| Jacksonville | $1.42 | $1.99 (1) | .... | .... |
| Tampa | $1.32 | .... | .... | .... |
| New Orleans | $0.97 | $1.65 (1) | 4 (1) | .... |
| Portland | $1.555 | .... | 5.3 (1) | 5.4 (1) |
| Boston | $1.555 | $2.19 (1) | 5.3 (2) | 5.3 –5.4 (2) |
| Providence | $1.525 | $2.192 (2) | 5.3 (1) | 5.3 –5.4 (2) |

# Gulf Coast

**Prices in Effect Dec. 31**

| MOTOR GASOLINE | New Orleans & Lower Mississippi to Baton Rouge Tank Cars | Barges | Texas Gulf Coast South of New Orleans Tank Cars | Barges | CARGOES Domestic & Export From all Gulf Ports |
|---|---|---|---|---|---|
| **Leaded** (cct. by ASTM) | | | | | |
| 78-80 oct. | 6.75 | 6.5 | 6.75 | 6.75 | 6.75 |
| 73-75 oct. | 6 – 6.25 | 5.75 | 5.75–6.5 (a) | 5.75 | 5.75 |
| 70 oct. | .... | .... | .... | .... | 5.625 |
| 80 oct. gasoline Research 2cc lead max. | .... | .... | .... | .... | 6 |
| **Unleaded** 70 oct. | .... | .... | .... | .... | 5.625 |
| 67-68 oct. | .... | .... | .... | .... | .... |
| 65 oct. | .... | .... | .... | .... | 5.25 |
| 60 oct. | .... | .... | .... | .... | 5 |
| **KEROSINE & LIGHT FUELS** | | | | | |
| 41-43 w.w. kero | 4.125–4.75(b) | 4.125–4.625(b) | 4.125–4.75(b) | 4.125–4.625(c) | 4.125–4.625(c) |
| 42-44 w.w. kero | .... | .... | 4.125–4.625(c) | 4.125–4.625(c) | 4.125–4.625(c) |
| No. 2 fuel oil | 3.75–3.95(c) | 3.75–3.95(c) | 3.75–4.2(d) | 3.75–3.95(c) | 3.75–3.95(c) |
| **DIESEL & GAS OILS** (In diesel index No.) | | | | | |
| No. 5 fuel oil | $1.05 | .... | $1.05 | .... | .... |
| 43-47 di. | .... | .... | .... | .... | 4 |
| 48-52 di. | 4 | 4 | 4 | .... | 4 |
| 53-57 di. | 4.125 | .... | 4.125 | 4.125 | 4.125 |
| 58 and above | 4.25 | .... | 4.25 | .... | 4.25 |

(a) 5.75c for Dist. 1 and 6.25-6.50 for other districts.
(b) 4.625–4.75—Dist. 1.
(c) High of range for Dist. 1 shipment.
(d) 3.95–4.2—Dist. 1.
NOTE: Above products in Truck Transports of 2,400 gal. and over ½c above Tank Car Prices.

| HEAVY FUELS & BUNKER OIL (all Gulf Ports) Heavy Diesels | In Cargoes | In Ship's Bunkers (Ex Lighterage) |
|---|---|---|
| Below 28 API Grav. | .... | $1.35 |
| 28 & above API Grav. | .... | $1.65 |
| Bunker C Oil | $0.97 | $0.97 |

## TANKER RATES

**Approximate rates, cents per bbl.; Gulf-N. Atlantic, not east of New York**

| | |
|---|---|
| Heavy crude & fuel, 10-19.9 grav. | 43.8 |
| Light crude, 30 grav. or lighter | 39 |
| Gasoline | 32.9 |
| Kerosine | 36 |
| No. 2 fuel | 38 |

## Mid-Continent Lubes

(At Gulf; in packages, FAS.; in bulk, FOB terminals).

**Prices in Effect Dec. 31**

| Bright Stock | Steel Drums | Bulk |
|---|---|---|
| *D color, Vis at* 210° | | |
| 200 vis. | .... | .... |
| 150 vis., 0-10 p.p. | 32.65 (1&a) | 24.8 (1) |
| 100 vis., 0-10 p.p. | .... | .... |
| 100 vis. 10-25 p.p. | .... | .... |
| Neutral—No. 3 color | | |
| 200 vis., 0-10 p.p. | .... | .... |

(A) FAS at New Orleans.

## Pacific Exports

*In Ship's Bunkers, or deep tank lots:*

| Prices in Effect | Dec. 31 | Dec. 21 |
|---|---|---|
| Diesel Fuel, Pac. Spec. 200 | $1.45 | $1.45 |
| Grade C fuel, Pac. Spec. 400 | $1.10 | $1.10 |

## Wax

(Melting points are AMP, 3° higher than EMP. Prices are FOB refinery and do not include bag; freight or export differentials).

**Prices in Effect Dec. 31**

| Crude Scale | New Orleans Export | N. Y. Domestic | N. Y. Export |
|---|---|---|---|
| 124-6 Yellow | 4.25 (1) | .... | 4.25 (1) |
| 122-4 White | .... | 4.25 (2) | 4.25(2) |
| 124-6 White | 4.25 (1) | 4.25 | 4.25 |
| **Fully Refined:** | | | |
| 123-5 | 5.2 (1) | 5.2 (2) | 5.2 (1) |
| 125-7 | 5.2 (1) | 5.2 (2) | 5.2 (2) |
| 128-30 | 5.6 (1) | 5.6 | 5.6 (1) |
| 130-32 | 5.85 (1) | 5.85 (2) | 5.85 (1) |
| 133-5 | 6.15 (1) | 6.15 | 6.15 (2) |
| 135-7 | 6.4 (1) | 6.4 (1) | 6.4 (1) |

## Naphtha

**Prices in Effect Dec. 31**

| | V.M.&P. Naphtha | Mineral Spirits |
|---|---|---|
| New York Harbor | 11 (2) | 10 |
| Philadelphia | 11 (2) | 10 |
| Baltimore | 10.5 (2) | 9.5 |
| Boston | 11.5 (2) | 10.5 |
| Providence | 11.5 (1) | 10.5 (2) |

## Export Prices

**Effective Dec. 31**

| | Mexican Gulf Ports U. S. Dollars per Bbl. Bunker C | Diesel |
|---|---|---|
| Tampico | $0.97 | $1.65 |
| Veracruz | 0.97 | .... |
| Coatzacoalcos | 0.97 | 1.65 |
| | **Pacific Coast** | |
| Guaymas | $1.50 | $3.22 |
| Mazatlan | 1.50 | 3.22 |
| Acapulco | 1.50 | 2.89 |
| Manzanillo | 1.50 | 2.89 |
| Salina Cruz | 1.50 | 2.89 |

## NPN Gasoline Index

| | Dealer T.W. | Tank Car |
|---|---|---|
| | Cents Per Gal. | |
| Dec. 31 | 9.97 | 6.42 |
| Month ago | 9.96 | 6.54 |
| Year ago | 10.38 | 6.72 |

Dealer index is an average of "undivided" dealer prices, ex-tax, in 50 cities.

Tank car index is weighted average of following wholesale markets for regular-grade gasoline, FOB refineries or terminals: Okla., Mid-Western, W. Penna., Calif., N. Y. Harbor, Philadelphia, Jacksonville, Boston and Gulf Coast.

# REFINERY OPERATIONS

*(American Petroleum Institute figures in thousands of barrels of 42 gallon each. Figures include reported totals plus estimate of unreported amounts and are therefore on a Bureau of Mines basis.)*

| Districts | Daily Average Crude Runs to Stills Week Ended | | Gasoline Production at Refineries inc. Natural Blended Week Ended | | Kerosine Production Week Ended | | Gas Oil & Dist. Fuel Oil Production Week Ended | | Residual Fuel Oil Production Week Ended | | Total Stocks Kerosine Week Ended | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dec. 22 | Dec. 15 | Dec. 22 | Dec. 15 | Dec. 22 | Dec. 15 | Dec. 22 | Dec. 15 | Dec. 22 | Dec. 15 | Dec. 22 | Dec. 15 |
| East Coast | 753 | 766 | 1,727 | 1,940 | 305 | 252 | 865 | 1,043 | 1,844 | 1,612 | 3,997 | 4,092 |
| Appalachian (Dist. 1) | 91 | 97 | 319 | 320 | 56 | 56 | 69 | 80 | 52 | 63 | 352 | 390 |
| Appalachian (Dist. 2) | 59 | 54 | 225 | 168 | 6 | 15 | 45 | 51 | 81 | 80 | 43 | 38 |
| Ind., Ill., Ky. | 752 | 727 | 2,727 | 2,588 | 353 | 323 | 616 | 579 | 1,011 | 976 | 1,962 | 2,115 |
| Okla., Kans., Mo. | 370 | 353 | 1,336 | 1,307 | 171 | 120 | 382 | 371 | 428 | 428 | 736 | 755 |
| Inland Texas | 214 | 201 | 918 | 866 | 91 | 86 | 103 | 93 | 363 | 324 | 226 | 246 |
| Texas Gulf Coast | 1,129 | 1,097 | 3,898 | 3,780 | 579 | 567 | 1,539 | 1,595 | 1,620 | 1,547 | 1,742 | 1,758 |
| Louisiana Gulf Coast | 277 | 298 | 845 | 836 | 245 | 220 | 290 | 514 | 283 | 354 | 850 | 965 |
| No. La. & Arkansas | 57 | 61 | 156 | 166 | 32 | 31 | 74 | 65 | 101 | 96 | 162 | 197 |
| Rocky Mt. (Dist. 3) | 13 | 13 | 36 | 37 | 6 | 6 | 11 | 11 | 30 | 31 | 20 | 20 |
| Rocky Mt. (Dist. 4) | 111 | 110 | 357 | 350 | 27 | 21 | 78 | 79 | 228 | 197 | 90 | 93 |
| California | 785 | 775 | 2,224 | 2,286 | 56 | 170 | 636 | 424 | 2,498 | 2,399 | 486 | 505 |
| Total U. S.—B. of M. Basis | 4,611 | 4,562 | 14,768 | 14,644 | 1,927 | 1,867 | 4,708 | 4,905 | 8,539 | 8,107 | 10,666 | 11,174 |
| U. S.—B. of M. Basis, Dec. 23, 1944 | 4,717 | 4,576 | 14,411 | 13,945 | 1,471 | 1,426 | 4,578 | 4,343 | 9,254 | 9,158 | 11,984 | 12,432 |

| Districts | Total Stocks Gas Oil and Distillates Week Ended | | Total Stocks Residual Fuel Oil Week Ended | | Finished and Unfinished Gasoline Week Ended | |
|---|---|---|---|---|---|---|
| | Dec. 22 | Dec. 15 | Dec. 22 | Dec. 15 | Dec. 22 | Dec. 15 |
| East Coast | 13,482 | 14,023 | 6,767 | 7,219 | 19,899 | 19,288 |
| Appalachian (Dist. 1) | 610 | 658 | 257 | 256 | 2,957 | 2,836 |
| Appalachian (Dist. 2) | 135 | 148 | 208 | 211 | 1,097 | 1,026 |
| Ind., Ill., Ky. | 5,559 | 5,890 | 2,792 | 2,843 | 18,537 | 17,702 |
| Okla., Kans., Mo. | 2,390 | 2,525 | 1,031 | 1,057 | 8,380 | 7,859 |
| Inland Texas | 409 | 413 | 800 | 819 | 2,747 | 2,742 |
| Texas Gulf Coast | 5,633 | 6,130 | 4,636 | 4,727 | 15,543 | 15,333 |
| Louisiana Gulf Coast | 1,734 | 1,912 | 1,496 | 1,520 | 4,103 | 4,156 |
| N. La. & Arkansas | 522 | 511 | 330 | 335 | 1,916 | 1,793 |
| Rocky Mt. (Dist. 3) | 16 | 19 | 30 | 29 | 102 | 103 |
| Rocky Mt. (Dist. 4) | 458 | 482 | 683 | 670 | 1,780 | 1,725 |
| California | 7,971 | 8,257 | 22,449 | 23,276 | 14,809 | 14,480 |
| Total U. S.—B. of M. Basis | 38,919 | 40,968 | 41,479 | 42,962 | °91,870 | 89,043 |
| U. S.—B. of M. Basis Dec. 23, 1944 | 40,129 | 41,759 | 58,173 | 59,118 | †83,607 | 82,996 |

Unfinished Gasoline Stocks included are (°) 7,955,000 barrels; (†) 12,716,000 barrels.

NOTE: Separation into Military and Civilian Grade discontinued, because of the increasing difficulty experienced by refiners in attempting to determine the ultimate disposition of these inventories.

Percent Daily Refining Capacity Reporting—East Coast 99.5; Appalachian (Dist. 1) 76.8, (Dist. 2) 81.2; Ind., Ill., Ky., 87.2; Okla., Kans., Mo., 78.3; Inland Texas, 59.8; Texas Gulf Coast, 89.3; Louisiana Gulf Coast 96.8; No. Louisiana & Arkansas, 55.9; Rocky Mt. (Dist. 3) 17.1; (Dist. 4) 72.1; California, 86.5; Total—U. S.—B. of M. Basis Dec. 22, 1945 85.7; Total—B. of M. Basis Dec. 15, 1945 85.7.

## U. S. Crude Oil Production

*(American Petroleum Institute figures)*

| | WEEK ENDED Dec. 22 Barrels (Daily Average) | Dec. 15 Barrels (Daily Average) |
|---|---|---|
| Oklahoma | °385,350 | °388,500 |
| Kansas | °256,450 | °264,850 |
| Nebraska | °750 | °750 |
| Texas | 1,922,400 | 1,918,900 |
| Louisiana | 371,900 | 371,450 |
| Arkansas | 75,900 | 75,900 |
| Mississippi | 54,400 | 53,600 |
| Alabama | 100 | 150 |
| Florida | 100 | 50 |
| Illinois | 204,250 | 211,300 |
| Indiana | 13,100 | 12,750 |
| Eastern (Ill., Ind. & Ky. excluded) | 56,050 | 60,800 |
| Kentucky | 28,950 | 28,900 |
| Michigan | 44,700 | 48,900 |
| Wyoming | 88,250 | 93,550 |
| Montana | 20,300 | 20,300 |
| Colorado | 21,000 | 20,450 |
| New Mexico | 97,900 | 97,900 |
| California | 837,800 | 845,700 |
| Total, U. S. | 4,479,650 | 4,514,700 |

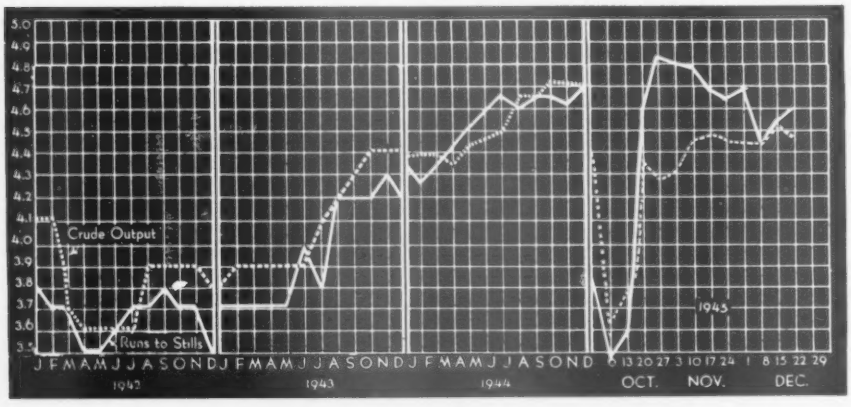
°Okla., Kans., Neb. figures are for week ended 7:00 a.m., Dec. 19, 1945.

## Crude Oil Stocks

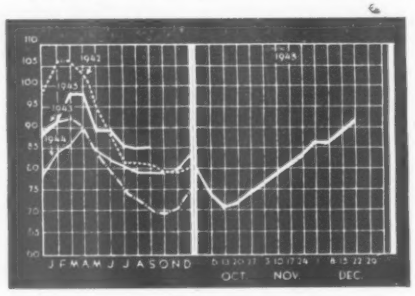
*(Bureau of Mines Figures in thousands of bbls.)*

| Grade or Origin | Dec. 15 | Dec. 22 | Change from Dec. 15 |
|---|---|---|---|
| Penna. Grade | 1,974 | 1,948 | — 26 |
| Other Appalachian | 1,499 | 1,481 | — 18 |
| Lima-Michigan | 995 | 1,002 | + 7 |
| Illinois-Indiana | 15,687 | 15,765 | + 78 |
| Arkansas | 2,370 | 2,423 | + 53 |
| Kansas | 9,865 | 9,881 | + 16 |
| Louisiana | 13,745 | 13,564 | —181 |
| Northern | 3,992 | 3,551 | —441 |
| Gulf Coast | 9,753 | 10,013 | +260 |
| Mississippi | 2,387 | 2,624 | +237 |
| New Mexico | 5,932 | 6,118 | +186 |
| Oklahoma | 33,608 | 33,451 | —157 |
| Texas | 103,491 | 104,228 | +737 |
| East Texas | 16,527 | 17,055 | +528 |
| West Texas | 32,462 | 32,703 | +241 |
| Gulf Texas | 29,417 | 29,366 | — 51 |
| Other Texas | 25,085 | 25,104 | + 19 |
| Panhandle | 4,241 | 4,327 | + 86 |
| North | 6,623 | 6,435 | —188 |
| South | 5,632 | 5,498 | —134 |
| Other | 8,589 | 8,844 | +255 |
| Rocky Mountain | 7,112 | 7,098 | — 14 |
| California | 18,049 | 18,265 | +216 |
| Foreign | 2,804 | 2,440 | —364 |
| Total gasoline-bearing in U. S. | 219,518 | 220,288 | +770 |
| Heavy in California | 4,460 | 4,350 | —110 |

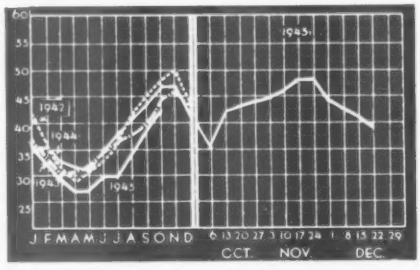
**Crude Production & Runs to Stills** *(Millions of Barrels)*


Crude Output
Runs to Stills
1943
1944
1945
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D 6 13 20 27 3 10 17 24 1 8 15 22 29
1942
1943
1944
OCT.
NOV.
DEC.

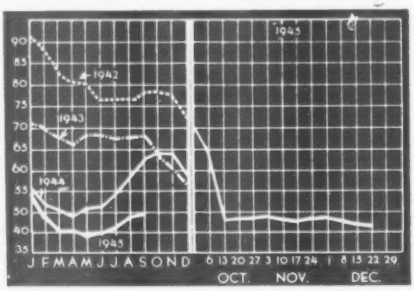
**Gasoline Stocks** *(Millions of Barrels)*



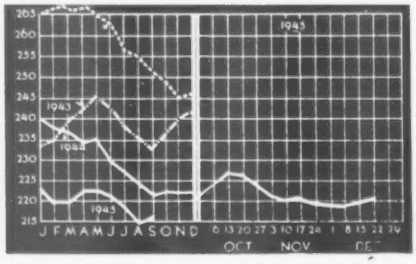

**Gas Oil & Distillate Stocks** *(Millions of Bbls.)*




**Residual Fuel Oil Stocks** *(Millions of Bbls.)*




**Crude Oil Stocks** *(Millions of Barrels)*



## Pacific Coast Demand

*(Bureau of Mines figures in thousands of bbls. daily)*

| | Gasoline | | Gas Oil & Diesel | | Heavy Fuel Oil | | All Products | |
|---|---|---|---|---|---|---|---|---|
| | 1944 | 1945 | 1944 | 1945 | 1944 | 1945 | 1944 | 1945 |
| January | 275 | 304 | 103 | 104 | 505 | 545 | 993 | 1,066 |
| February | 315 | 315 | 109 | 100 | 478 | 594 | 1,011 | 1,124 |
| March | 311 | 332 | 108 | 94 | 479 | 519 | 1,018 | 1,068 |
| April | 302 | 406 | 88 | 83 | 450 | 536 | 954 | 1,148 |
| May | 295 | 402 | 85 | 75 | 411 | 520 | 900 | 1,135 |
| June | 352 | 398 | 87 | 64 | 395 | 490 | 969 | 1,085 |
| July | 335 | 396 | 63 | 59 | 353 | 421 | 884 | 1,011 |
| August | 329 | 370 | 63 | 78 | 349 | 434 | 883 | 1,010 |
| September | 323 | 363 | 65 | 76 | 382 | 400 | 902 | 954 |
| October | 313 | 269 | 70 | 76 | 450 | 443 | 945 | 897 |
| November | 328 | ... | 80 | ... | 467 | ... | 992 | ... |
| December | 319 | ... | 101 | ... | 558 | ... | 1,093 | ... |
| Jan.-Oct. | 315 | 355 | 84 | 81 | 425 | 489 | 946 | 1,049 |

## Mid-Continent Lube Statistics (September 1945)

*(Compiled by Western Petroleum Refiners Assn. from reports of member companies. Figures in bbls. of 42 gal.)*

| | Bright Stock | Viscous Neutrals | Paraffin Oils | Steam Refined Stock | Blended Oils |
|---|---|---|---|---|---|
| Production | 215,780 | 293,129 | 47,856 | 17,886 | 314,182 |
| Shipments: | | | | | |
| Domestic | 175,264 | 289,428 | 49,235 | 18,454 | 289.128 |
| Export | 5,509 | 1,318 | 33 | 156 | 7,359 |
| TOTAL | 180,773 | 290,746 | 49,268 | 18,610 | 296,487 |
| Inventory Sept. 30, '45 | 176,233 | 169,179 | 57,646 | 39,726 | 137,487 |

## Pennsylvania Lubricating Oils

*(Compiled by National Petroleum Assn. from reports of companies refining Pennsylvania Grade crude oil. Figures in bbls.)*

| | Production Oct. 1945 | Inventory Oct. 1945 | Production Sept. 1945 | Inventory Sept. 1945 |
|---|---|---|---|---|
| Raw Long Residuum | 45,168 | 29,684 | 43,314 | 33,110 |
| 600 Steam Refined Stock | 237,688 | 97,930 | 237,355 | 73,853 |
| Other Steam Refined Stock | 47,303 | 30,280 | 38,691 | 34,643 |
| Finished dewaxed Long Residuum | 46,962 | 31,424 | 44,304 | 30,417 |
| Bright Stock | 135,977 | 178,845 | 149,766 | 181,002 |
| Viscous Neutral (below 180 Vis.) | 68,381 | 148,194 | 56,088 | 136,553 |
| Viscous Neutral (180 Vis. at 100) | 81,891 | 93,691 | 86,866 | 114,312 |

## Production of Natural 'Gas', Allied Products

| | Oct., 1945 | Sept., 1945 |
|---|---|---|
| East Coast | .... | .... |
| W. New York | .... | .... |
| W. Pennsylvania | 1,151 | 831 |
| West Virginia | 8,785 | 5,135 |
| Ohio | 554 | 467 |
| Illinois | 13,656 | 12,677 |
| Kentucky | 4,862 | 1,272 |
| Michigan | 1,062 | 1,159 |
| Kansas | 6,010 | 6,114 |
| Oklahoma | 33,942 | 34,199 |
| Texas: | 177,857 | 169,573 |
| Gulf | 43,611 | 41,517 |
| East Texas | 27,663 | 29,702 |
| Panhandle | 45,487 | 44,002 |
| Other | 61,096 | 54,352 |
| Arkansas | 6,204 | 6,185 |
| Louisiana: | 42,540 | 27,316 |
| Gulf | 24,301 | 20,722 |
| Inland | 18,239 | 6,594 |
| New Mexico | 8,056 | 8,747 |
| Colorado | (*) | (*) |
| Montana | 371 | 357 |
| Wyoming | *3,624 | *3,603 |
| California | 70,469 | 72,192 |
| Total | 379,143 | 349,827 |
| Daily average | 12,230 | 11,661 |
| Total (thousands of bbls.) | 9,027 | 8,329 |
| Daily average | 12,230 | 11,661 |

*Wyoming includes Colorado drip gasoline.

## Dealer and Service Station Gasoline Prices in 50 Representative U. S. Cities October, 1945

| City | Dealers' Net Price (Ex. Tax) | Indicated Dealer Margin | Gasoline Tax (Inc. 1½ Cent Federal Tax) | Service Station (Inc. Tax) |
|---|---|---|---|---|
| Portland, Me. | 9.60 | 4.0 | 5.50 | 19.10 |
| Manchester, N. H. | 10.60 | 4.1 | 5.50 | 20.20 |
| Burlington, Vt. | 10.20 | 4.0 | 5.50 | 19.70 |
| Boston, Mass. | 9.20 | 4.0 | 4.50 | 17.70 |
| Providence, R. I. | 9.30 | 4.2 | 4.50 | 18.00 |
| Hartford, Conn. | 9.90 | 4.0 | 4.50 | 18.40 |
| Buffalo, N. Y. | 9.50 | 4.5 | 5.50 | 19.50 |
| New York, N. Y. | 9.40 | 5.4 | 5.50 | 20.30 |
| Newark, N. J. | 9.00 | 5.0 | 4.50 | 18.50 |
| Philadelphia, Pa. | 9.00 | 4.0 | 5.50 | 18.50 |
| Dover, Del. | 9.50 | 4.5 | 5.50 | 19.50 |
| Baltimore, Md. | 8.75 | 3.95 | 5.50 | 18.20 |
| Washington, D. C. | 9.00 | 4.0 | 4.50 | 17.50 |
| Charleston, W. Va. | 11.05 | 4.05 | 6.50 | 21.60 |
| Norfolk, Va. | 9.25 | 5.55 | 6.50 | 21.30 |
| Charlotte, N. C. | 10.90 | 4.0 | 7.50 | 22.40 |
| Charleston, S. C. | 9.75 | 4.75 | 7.50 | 22.00 |
| Atlanta, Ga. | 10.50 | 4.0 | 7.50 | 22.00 |
| Jacksonville, Fla. | 9.50 | 4.0 | 8.50 | 22.00 |
| Birmingham, Ala. | 10.00 | 5.0 | 8.50 | *23.50 |
| Vicksburg, Miss. | 9.50 | 5.0 | 7.50 | 22.00 |
| Memphis, Tenn. | 8.90 | 4.5 | 8.50 | 21.90 |
| Lexington, Ky. | 10.50 | 3.5 | 6.50 | 20.50 |
| Youngstown, Ohio | 9.50 | 3.0 | 5.50 | 18.00 |
| South Bend, Ind. | 10.50 | 4.5 | 5.50 | 20.50 |
| Chicago, Ill. | 9.60 | 2.76 | 4.50 | 16.86 |
| Detroit, Mich. | 9.90 | 3.74 | 4.50 | 18.14 |
| Milwaukee, Wisc. | 10.60 | 4.3 | 5.50 | 20.40 |
| Twin Cities, Minn. | 10.40 | 4.5 | 5.50 | 20.40 |
| Fargo, N. Dak. | 11.40 | 4.0 | 5.50 | 20.90 |
| Huron, S. Dak. | 10.80 | 3.7 | 5.50 | 20.00 |
| Omaha, Neb. | 9.60 | 3.0 | 6.50 | 19.10 |
| Des Moines, Ia. | 9.90 | 3.5 | 5.50 | 18.90 |
| St. Louis, Mo. | 9.50 | 3.0 | 4.50 | *17.00 |
| Wichita, Kans. | 8.80 | 3.2 | 4.50 | 16.50 |
| Tulsa, Okla. | 8.00 | 3.0 | 9.00 | 20.00 |
| Little Rock, Ark. | 9.50 | 4.5 | 8.00 | 22.00 |
| New Orleans, La. | 8.75 | 4.75 | 8.50 | 22.00 |
| Houston, Texas | 8.50 | 4.5 | 5.50 | 18.50 |
| Albuquerque, N. Mex. | 10.50 | 4.5 | 7.00 | **22.00 |
| Denver, Colo. | 10.00 | 4.0 | 5.50 | 19.50 |
| Casper, Wyo. | 11.50 | 5.0 | 5.50 | 22.00 |
| Butte, Mont. | 9.50 | 4.0 | 6.50 | 20.00 |
| Boise, Ida. | 13.50 | 4.0 | 7.50 | 25.00 |
| Salt Lake City, Utah | 13.50 | 4.5 | 5.50 | 23.50 |
| Reno, Nev. | 12.00 | 4.0 | 5.50 | 21.50 |
| Phoenix, Ariz. | 12.00 | 4.0 | 6.50 | 22.50 |
| San Francisco, Calif. | 10.00 | 4.0 | 4.50 | 18.50 |
| Portland, Ore. | 10.50 | 4.0 | 6.50 | 21.00 |
| Spokane, Wash. | 12.50 | 4.0 | 6.50 | 23.00 |

* Includes City Tax of $.0100.
** Includes City Tax of $.0050.

## Pennsylvania Oils Other Than Lubes At Refineries

*(Compiled by National Petroleum Assn. from reports of oil region refiners. Figures in barrels.)*

| | Oct. 1945 | Sept. 1945 |
|---|---|---|
| Naphthas & Gasoline | | |
| (1) Straight run, unblended and/or unleaded, for sale as motor fuel | 3,406 | 2,540 |
| (2) Naphtha and gasoline, for sale for blending or further refining, or held at refinery for further distillation, reforming, blending or leading | 186,154 | 220,080 |
| (3) Below 65 Octane, not included in (1) or (2) above | 1,059 | 1,112 |
| (4) 65 Octane and above | 154,283 | 137,654 |
| Salable Naphthas other than motor fuel material (does not include refinery process naphthas) | 13,159 | 15,648 |
| Kerosene | 90,052 | 99,839 |
| 36/40 gas oil (include furnace oil) | 71,789 | 72,339 |
| Fuel oil (not reported above) | 35,019 | 36,190 |
| Oils held as cracking plant charging stocks | 445,057 | 403,658 |
| Non-viscous neutral | 29,557 | 32,181 |
| Wax distillate | 106,788 | 86,276 |
| Crude petrolatum | 31,513 | 32,145 |
| Wax (lbs.) | 3,299,509 | 4,034,259 |

## Net Stocks Of Pennsylvania Crude Oil

*(Compiled by National Petroleum Assn. Figures in bbls.)*

| | Oct. 31, 1945 | Sept. 30, 1945 | Oct. 31, 1944 |
|---|---|---|---|
| At Refineries | 362,390 | 301,247 | 325,692 |
| Pipeline and Tank Farm | 1,528,417 | 1,449,065 | 1,464,893 |

## CRUDE PRICES

Since changes in crude oil prices are few, the two pages of crude oil price tables are printed only when there are sufficient changes to warrant.

A record is kept in the Cleveland office of NPN and OILGRAM from which the publishers will be glad to make proofs, or letters or affidavits as to what the prices are, and without charge to regular subscribers.

**Crude Price Changes**

*No price changes for week ending Dec. 26.*

*For latest table of crude prices published, see NPN Dec. 26, pages 42, 43 and 44.*

### Daily Av. Pennsylvania Crude Runs

*(Compiled by National Petroleum Assn. from reports of all companies refining Pennsylvania crude. Figures in bbls.)*

| Week Ended Dec. 22, 1945 | Week Ended Dec. 15, 1945 | Week Ended Dec. 23, 1944 |
|---|---|---|
| 58,324 | 62,655 | 62,477 |

## Okays Texas Commission Chief Engineer Post at $7750 a Year

*Special to NPN*

AUSTIN, Tex. — Attorney General Grover Sellers has ruled that the Railroad Commission may employ a chief engineer at $7750 a year. Capital talk was that the job will be offered to Jack K. Baumel, who has announced his resignation as director of production for the oil and gas division, a $5000 a year job. It also is understood that Clark Lloyd who has also planned to leave the commission, will be given the $5000 job.

The opinion was requested by Commissioners Beauford H. Jester and Ernest O. Thompson, who said there is no similar position in the department now. They inquired whether a chief engineer could be hired and whether he could be paid a salary equal to the $7750 a year received by the state highway engineer.

## Wartime Truck Regulations Rescinded in North Carolina

*Special to NPN*

RALEIGH, N. C.—State wartime regulations which allowed any truck to haul up to 4300 gals. of petroleum products, regardless of the weight, were rescinded as of Jan. 1, along with other regulations set up under the governor's wartime powers act.

Prewar regulations limited the weight of loads for one-axle petroleum trucks to 40,000 pounds. The 1945 legislature set the load limit for two-axle gasoline trucks at 50,000 pounds.

Petroleum transporters had requested an extension of time before the old regulations became effective. A delegation of 30 haulers pointed out to Gov. R. Gregg Cherry that further restrictions on load limits might cause a gasoline and fuel oil shortage in the state. The delegation told Gov. Cherry that present equipment had been converted to operate under the wartime regulations, and that should the prewar regulations go back into effect before new equipment was available, there would be much loss of loading space, thus reducing the amount of incoming products by highway transportation.

## OPA Asks Rationing Report

WASHINGTON—OPA has asked its district and regional offices for a report on all gasoline and fuel oil rationing cases pending as of January 1, meanwhile instructing enforcement officers not to file new suits except in flagrant cases.

## GASOLINE CONSUMPTION BY STATES, SEPTEMBER 1945

| | Tax Rate* September Cents | Month of Aug., 1945 Gallons | Month of Sept., 1945 Gallons | Month of Sept., 1944 Gallons | Change % | 9 Months Ending With Sept., 1945 Gallons | 9 Months Ending With Sept., 1944 Gallons | Change % |
|---|---|---|---|---|---|---|---|---|
| Alabama | 6 | 28,158,000 | 28,519,000 | 22,883,000 | +24.63 | 222,538,000 | 193,915,000 | +14.76 |
| Arizona | 5 | 10,854,000 | 11,603,000 | 9,213,000 | +25.94 | 94,258,000 | 100,257,000 | — 5.98 |
| Arkansas | 6½ | 21,610,000 | 20,473,000 | 15,723,000 | +30.21 | 155,528,000 | 132,224,000 | +17.62 |
| California | 3 | 263,765,000 | 268,205,000 | 207,459,000 | +29.28 | 2,025,504,000 | 1,797,069,000 | +12.71 |
| Colorado | 4 | 32,416,000 | 29,892,000 | 27,002,000 | +10.70 | 230,885,000 | 228,452,000 | + 1.06 |
| Connecticut | 3 | 28,565,000 | 27,628,000 | 22,816,000 | +21.09 | 219,954,000 | 204,662,000 | + 7.47 |
| Delaware | 4 | 6,422,000 | 5,379,000 | 4,390,000 | +22.53 | 40,676,000 | 38,490,000 | + 5.68 |
| District of Columbia | 3 | 10,640,000 | 10,493,000 | 9,000,000 | +16.59 | 84,882,000 | 81,249,000 | + 4.47 |
| Florida | 7 | 35,441,000 | 35,481,000 | 30,154,000 | +27.61 | 304,829,000 | 284,744,000 | + 7.05 |
| Georgia | 6 | 40,226,000 | 39,294,000 | 31,830,000 | +23.45 | 312,994,000 | 279,793,000 | +11.87 |
| Idaho | 6 | 11,851,000 | 12,154,000 | 9,595,000 | +26.67 | 80,753,000 | 71,293,000 | +13.27 |
| Illinois | 3 | 116,588,000 | 118,034,000 | 99,257,000 | +18.92 | 937,165,000 | 881,246,000 | + 6.35 |
| Indiana | 4 | 67,784,000 | 73,733,000 | 60,036,000 | +22.81 | 580,163,000 | 535,682,000 | + 8.30 |
| Iowa | 3 | 56,781,000 | 54,615,000 | 41,152,000 | +32.71 | 448,492,000 | 403,309,000 | +11.20 |
| Kansas | 3 | 54,429,000 | 47,613,000 | 43,337,000 | + 9.87 | 376,918,000 | 347,046,000 | + 9.47 |
| Kentucky | 5 | 34,753,000 | 34,577,000 | 29,450,000 | +17.41 | 279,539,000 | 219,436,000 | +27.39 |
| Louisiana | 7 | 32,649,000 | 32,986,000 | 27,144,000 | +21.52 | 251,593,000 | 227,787,000 | +10.45 |
| Maine | 4 | 15,331,000 | 14,491,000 | 11,863,000 | +22.15 | 108,437,000 | 98,462,000 | +10.13 |
| Maryland | 4 | 29,356,000 | 27,555,000 | 24,311,000 | +13.34 | 247,616,000 | 218,570,000 | +13.29 |
| Massachusetts | 3 | 57,506,000 | 55,610,000 | 46,880,000 | +18.62 | 437,816,000 | 398,671,000 | + 9.82 |
| Michigan | 3 | 115,173,000 | 100,117,000 | 101,581,000 | — 1.44 | 870,643,000 | 812,763,000 | + 7.12 |
| Minnesota | 4 | 54,741,000 | 56,833,000 | 42,593,000 | +33.43 | 392,118,000 | 347,599,000 | +12.81 |
| Mississippi | 6 | 20,839,000 | 23,512,000 | 15,659,000 | +50.15 | 171,657,000 | 153,971,000 | +11.48 |
| Missouri | 2 | 58,237,000 | 58,412,000 | 44,248,000 | +32.01 | 428,908,000 | 389,809,000 | +10.03 |
| Montana | 5 | 17,124,000 | 13,371,000 | 12,473,000 | + 7.20 | 101,513,000 | 91,022,000 | +11.52 |
| Nebraska | 5 | 28,685,000 | 26,533,000 | 22,024,000 | +20.47 | 199,945,000 | 178,909,000 | +11.76 |
| Nevada | 4 | 4,835,000 | 5,362,000 | 5,207,000 | + 2.98 | 38,269,000 | 47,929,000 | —20.15 |
| New Hampshire | 4 | 8,730,000 | 8,101,000 | 6,293,000 | +28.73 | 55,856,000 | 49,918,000 | +11.90 |
| New Jersey | 3 | 69,464,000 | 76,727,000 | 60,820,000 | +26.15 | 559,457,000 | 519,528,000 | + 7.68 |
| New Mexico | 5 | 12,799,000 | 12,339,000 | 8,985,000 | +37.33 | 94,788,000 | 82,295,000 | +15.18 |
| New York | 4 | 144,138,000 | 145,447,000 | 120,775,000 | +20.43 | 1,088,618,000 | 1,044,827,000 | + 4.19 |
| North Carolina | 6 | 40,520,000 | 42,653,000 | 37,300,000 | +14.35 | 336,144,000 | 307,489,000 | + 9.32 |
| North Dakota | 4 | 25,205,000 | 21,302,000 | 18,641,000 | +14.27 | 149,253,000 | 134,220,000 | +11.20 |
| Ohio | 4 | 132,503,000 | 120,751,000 | 116,987,000 | + 3.22 | 1,053,603,000 | 1,039,192,000 | + 1.39 |
| Oklahoma | 7½ | 59,369,000 | 42,818,000 | 52,224,000 | —18.01 | 454,758,000 | 353,515,000 | +28.64 |
| Oregon | 5 | 28,841,000 | 29,359,000 | 24,126,000 | +21.69 | 203,554,000 | 198,917,000 | + 2.33 |
| Pennsylvania | 4 | 122,482,000 | 119,401,000 | 98,124,000 | +21.68 | 914,241,000 | 848,584,000 | + 7.74 |
| Rhode Island | 3 | 12,587,000 | 11,049,000 | 10,925,000 | + 1.14 | 94,527,000 | 88,820,000 | + 6.42 |
| South Carolina | 6 | 21,051,000 | 20,444,000 | 16,568,000 | +23.40 | 160,904,000 | 147,306,000 | + 9.23 |
| South Dakota | 4 | 18,124,000 | 16,145,000 | 12,577,000 | +28.37 | 117,316,000 | 101,639,000 | +15.42 |
| Tennessee | 7 | 30,989,000 | 35,879,000 | 22,230,000 | +61.40 | 270,942,000 | 250,749,000 | + 8.05 |
| Texas | 4 | 429,257,000 | 292,467,000 | 386,882,000 | —20.71 | 3,580,899,000 | 2,978,266,000 | +20.23 |
| Utah | 4 | 12,729,000 | 12,830,000 | 9,096,000 | +41.05 | 88,118,000 | 77,343,000 | +13.93 |
| Vermont | 4 | 5,802,000 | 6,039,000 | 4,123,000 | +46.47 | 39,221,000 | 32,995,000 | +18.87 |
| Virginia | 5 | 44,869,000 | 42,997,000 | 39,085,000 | +10.00 | 348,699,000 | 322,497,000 | + 8.12 |
| Washington | 5 | 42,100,000 | 41,125,000 | 32,197,000 | +27.73 | 301,182,000 | 278,464,000 | + 8.15 |
| West Virginia | 5 | 17,034,000 | 17,844,000 | 12,154,000 | +46.82 | 134,965,000 | 117,954,000 | +14.42 |
| Wisconsin | 4 | 60,639,000 | 59,840,000 | 43,921,000 | +36.24 | 428,642,000 | 364,526,000 | +17.59 |
| Wyoming | 4 | 7,471,000 | 8,620,000 | 6,838,000 | +26.06 | 54,420,000 | 51,873,000 | + 4.91 |
| Total | | 2,601,462,000 | 2,416,652,000 | 2,158,151,000 | | 20,173,700,000 | 18,155,276,000 | |
| Daily Average | | 83,918,000 | 80,555,000 | 71,938,000 | | 73,896,000 | 66,260,000 | |
| Change from previous year: | | | | | | | | |
| Total Change | | | +258,501,000 | | | +2,018,424,000 | | |
| Percentage change in Daily Average | | | +11.98% | | | +11.52% | | |

*These are State tax rates per gallon. In addition there is the Federal tax of one and one-half cents (1½c) per gallon.

## Field and Factory Training Schools for Oil Heat Servicemen Conducted by Oil-O-Matic

*Special to NPN*

BLOOMINGTON, Ill. — Recognizing the value, to the oil burner owner, dealer and manufacturer, of having a well-trained serviceman on the job, Williams Oil-O-Matic Division, Eureka Vacuum Cleaner Co., is carrying over into its postwar program its field and factory service schools.

James H. Lahey, director of training, declares the knowledge gained through experiences of preceding years provided the basis upon which plans were set up for postwar service schools. To this was added knowledge acquired by the training department during the war years when it was called upon to assist in development of skilled and semi-skilled workers. As a result, new methods of instruction and modern training aids are now employed in the oil burner service schools.

The firm recently completed a series of field service schools in the East which was attended by about 250 dealers and servicemen. The first four postwar factory service schools have been attended by about 130 dealers and servicemen.

Field service schools are of two or three-day duration and are conducted by members of the Oil-O-Matic staff. Each is especially trained in the skills and techniques necessary to the teaching of others.

Training aids used by field instructors consist of: a series of 43 wall charts; mock-ups of component parts of burners; cutaway models; working models, and other printed supplementary and reference material. Whenever possible, the program is designed to meet the particular needs of the group attending. Field service schools may orientate a man who will later attend the factory school, or may serve as a refresher training for one who has previously received factory instruction.

There are two types of factory training programs. Six full days of instruction are provided for beginners in the oil burner business. For the dealer or serviceman with prior experience in oil heating, a special three-day refresher training is provided.

Various types of heating plants, typical of those in which oil burners are installed, are set up in the training department, Mr. Lahey said. Here the serviceman becomes familiar with the importance of selecting the right size and type of burner which will meet the requirements of a particular installation.

He also becomes acquainted with the steps to be taken for converting a heating plant to an oil burning facility. This includes computing heat loss, inspection of heating system to determine if the system is satisfactory for use with an oil burner. It also includes determination of combustion chamber requirements, the actual bricking of combustion chambers, setting fire with instruments and testing the installation and its electrical controls.

Considerable time, Mr. Lahey explained, is spent by the serviceman on actual service problems. This requires that he determine the cause and location of service difficulties. Having given evidence of his knowledge of corrective measures to be taken, the serviceman actually performs the service required to restore the heating facility to maximum efficiency.

Selections of training candidates are made by Oil-O-Matic dealers and attendance at each school is limited.

The Oil-O-Matic staff of instructors includes a group of five men, each possessing technical information and job skill gained through years of practical experience obtained in the field and at the factory. Collectively the group has a total of 104 years of oil burner experience, an average of more than 20 years each.

## *He Got the DSM and Christmas at Home*

NPN News Bureau

WASHINGTON — It was truly a merry Christmas for Col. Gustave H. Vogel, former chief of the Petroleum Section, Allied Forces Headquarters of the Army-Navy Petroleum Board.

Adm. F. J. Horne, special assistant to the Chief of Naval Operations and member of A-NPB, had pinned the Distinguished Service Medal on the colonel's broad chest. And the affable Army Officer, 40 months overseas with only two nine-day "breaks," got to spend Christmas at home for the first time in five years.

"When you have three growing boys," he observes, "that's something."

He was on a plane bound for home on V-J Day, and launched on his A-NPB activities the very next day last August, relieving Col. Harry W. McCobb.

The citation accompanying his award said that Col. Vogel developed the petroleum supply machinery of the Mediterranean Theater by applying the maximum and most efficient bulk handling facilities ever attempted in a theater of war, the success of which was largely due to his own farsightedness and conviction, and the result of experiments which he pioneered.

It said also that, because of Col. Vogel's relentless devotion to duty, willingness to accept responsibility and thorough understanding of petroleum logistics, all petroleum activities affecting military and civilian agencies in the Mediterranean area were controlled and co-ordinated with conspicuously outstanding efficiency, despite the handicaps imposed by the complexities of a vast war area.

Col. Vogel

## Crude Stocks Increase by 770,000 Bbls. as of Dec. 22

NPN News Bureau

WASHINGTON — Domestic and foreign crude stocks totaled 220,288,000 bbls. at the close of the week ended Dec. 22, up 770,000 bbls. from the previous week, the Bureau of Mines announced.

There was an increase of 1,134,000 bbls. in domestic crude stocks and a decrease of 364,000 bbls. in foreign crude. Heavy crude stocks in California totaled 4,350,000 bbls., down 110,000 bbls. from preceding week.

Major increases in domestic stocks were in Texas, up 737,000 bbls., and Mississippi, up 237,000 bbls.

Major decreases were in Louisiana, down 181,000 bbls., and Oklahoma, down 157,000 bbls.

## Bids to be Opened on Drums And Cans in Fort Worth

*Special to NPN*

FORT WORTH, Texas — Bids will be open at 11 a.m. Jan. 7, at Office of Surplus Property, Department of Commerce, here on the following: at J. & L. Steel Barrel Co., Port Arthur, minimum quantity 300 per customer, used drums needing reconditioning, 55 gal. steel 14, 16 and 18 gauge, 16,761 each; at Dixie Petroleum Co., San Antonio, minimum quantity 1000, 120,390 used blitz cans needing repairs, 5 gal. inflammable liquid, and used drums needing reconditioning, 55 gal. steel 14, 16 and 18 gauge, 55,244 each, minimum quantity 300 per customer.

# CLASSIFIED

## For Sale

**NEW TANKS**

We can give fairly prompt delivery on storage tanks 280 and 550 gallon capacity. We invite your inquiries.

EMPIRE EQUIPMENT CORPORATION
608 Empire Bldg.
Cleveland 14, Ohio
Phone: Main 7667

**FOR SALE**

GASOLINE, FUEL OIL & PROPANE
BULK PLANTS
DESIGNED & ERECTED COMPLETE

WRITE FOR DETAILS OF OUR
TIME PAYMENT PLAN

KENNEY TANK INSTALLATION CO.
2132 N. Halsted St.
Chicago 14, Illinois

**FOR SALE**

2—1945 Federal 29M2 Truck-Tractors; one 9:00 x 20 all around, other 9:00 x 20 front 10:00 x 20 rear. Both units equipped 9-10" rims, air over hydraulic (dual system) brakes, air horns, air wipers, hand control valve. Approximately 17,000 miles. Perfect condition.

1—1942 Federal 29 Truck-Tractor, 9:00 x 20 front, 10:00 x 20 rear, 9-10" rims, Straight air brakes, air horns, air wiper, hand control valve. Completely overhauled. Excellent condition.

1—1943 Standard Steel 4100 gallon 3 compartment semi-trailer. Air brakes, landing props, 10:00 x 20 tires, 3" lines manifolded, ICC specifications. Excellent condition.

1—1942 Progress Manufacturing Co. 4050 gallon single compartment semi-trailer. Air brakes, landing props, 10:00 x 20 tires, 3" line, ICC specifications. Excellent condition.

1—1939 Columbian 3575 gallon 4 compartment semi-trailer. Air brakes, landing props, 10:00 x 20 tires, 2" lines manifolded, ICC specifications. Excellent condition.

HOME OIL TERMINAL COMPANY
P.O. Box 397, Henderson, Ky.

## Wanted to Buy

WANTED. Released Naval Lieutenant desires to purchase oil jobbing business or secure distributorship in Ohio, Indiana or Michigan. Would also consider purchase, or lease with purchase option, of super service station in small city. Have extensive experience in petroleum distribution. Can furnish excellent references. Capital investment limited to $15,000. Box 751.

**WANTED**

3000 and 5000 gallon underground tanks, new or used. Must be in good condition. Wire complete information.

Charleston Oil Company
Box 8, Station A
Charleston, S. C.

## Business Opportunity

HERE'S A CHANCE FOR YOU AND US!

REFINOL OIL COMPANY (G. KODDE)
plants and offices: Galileistraat 75
Rotterdam (Netherlands)
INDEPENDENT importers of petroleum-products
own park of tank-trucks
own tank-storage capacity 3,000,000 Gallons
own quays and railway-tracks located at water and railway

ASKS FOR

complete offers from absolutely independent refiners FOR THE WHOLE LINE of petroleum-products, such as:

GASOLINE — KEROSINE — FUEL-OIL — SPINDLE-OIL — MOTOROILS —PARAFFIN—WHITE OILS & PETROLATUM (technical and pharmaceutical) — CYLINDEROILS — TRANSFORMER-OIL — TURBINE-OILS — GREASES AND ALL KINDS OF DERIVATES.

Quote us soonest possible your prices f.a.s. U.S.A.—ports, in bulk or in original packages.

YOU CAN DO A LOT OF BUSINESS IN THE NETHERLANDS IF YOU COOPERATE WITH REFINOL OIL COMPANY—ROTTERDAM.

## Wanted to Buy.

**WANTED**

NEWLY FORMED SYNDICATE DESIRES TO ACQUIRE ESTABLISHED MARKETING FACILITIES ON EASTERN SEABOARD. BULK PLANTS—WATER TERMINALS — SERVICE STATIONS AND FUEL OIL DISTRIBUTION. NOW MARKETING BRANDED OR UNBRANDED.

PREFER OPERATIONS IN EASTERN PENNA. AND DELAWARE AND MARYLAND—DISTRICT COLUMBIA.

DESIRE TO PURCHASE WELDED TANKAGE TEN—FIFTEEN—TWENTY FIVE THOUSAND BARREL CAPACITY FOR REMOVAL WILL ALSO PURCHASE ALL FITTINGS PUMPS METERS STEEL LOADING RACKS.

ALL REPLIES WILL BE TREATED WITH CONFIDENCE.

BOX 750

## Professional Services

ANTI-KNOCK VALUES
DETERMINATORS
The Gray Industrial Laboratories
*Chemists and Engineers*
*Specialists on Petroleum Products*
961-976 Frelinghuysen Ave.,
NEWARK, N. J.
Telephone Bigelow 3-4020

**ACCURATE LABORATORY TESTS**
**GASOLINE OIL**
Standard Methods Employed
Octane Ratings by A.S.T.M. CFR Unit
THE DETROIT TESTING LABORATORY
554 Bagley Avenue, Detroit 26, Mich.

**J. BJORKSTEN, PH. D.**

Offers close personal direction of difficult industrial research assignments.

BJORKSTEN LABORATORIES
185 N. Wabash Ave., Chicago 1, Ill.
Telephone ANdover 1726

## Classified Rates

"For Sale," "Wanted to Buy," "Help Wanted," "Business Opportunities," "Miscellaneous" classifications, set in type this size without border—15 cents a word. Minimum charge, $4.00 per insertion.

"Position Wanted"—10 cents a word. Minimum charge $1.50 per insertion.

Advertisements set in special type or with border—$5.00 per column inch.

Copy must reach us not later than Saturday preceding date of issue.

All classified advertisements are payable in advance.

No agency commission or cash discounts on classified Advertisements.

## ADVERTISERS' INDEX

*This index is published as a convenience to the reader. Every care is taken to make it accurate but National Petroleum News assumes no responsibility for errors or omissions.*


Autocar Co. ..... 17

Blackmer Pump Co. ..... 30
Butcher-Arthur, Inc. ..... 34

Chicago Bridge & Iron Co. ..... 15

Ethyl Corp. ..... 1

General American Transportation Corp. . . 26-27
Gilbert & Barker Mfg. Co. . . Outside Back Cover

Hanlon-Buchanan, Inc. ..... 23
Heil Co. ..... 31

Kellogg Co., M. W. ..... 20-21

National Steel Container Corp. ..... 18

Philadelphia Valve Co. ..... 25
Purolator Products, Inc. ..... 29
Pyrene Manufacturing Co. ..... 32

Scully Signal Co. ..... 33
Socony-Vacuum Oil Co., Inc. . Inside Back Cover

Tokheim Oil Tank & Pump Co. .....
..... Inside Front Cover

White Motor Co. ..... 13
Wood River Oil & Refining Co., Inc. ..... 28

## Top Oil Industry Officials Represented in New Book

"Our Oil Resources," a new book edited by Leonard M. Fanning and published by McGraw-Hill, is a symposium of opinion, quite authoritative. It contains a number of papers previously published or presented in addresses by top oil industry officials.

Represented in the book are John A. Brown, late president, Socony-Vacuum, and J. C. Hunter, late President, Mid-Continent Oil & Gas Assn. and long a member of Interstate Oil Compact Commission; three officials of Standard of New Jersey—Eugene Holman, President and new Chairman of the Executive Committee, Frank W. Abrams and Wallace E. Pratt, two vice presidents. Mr. Abrams was named chairman of the board last month. Some other industry men who contributed articles are O. D. Donnell and A. Jacobsen, Presidents of Ohio Oil and Amerada Petroleum; and John M. Lovejoy, head of Seaboard Oil. Dr. Robert E. Wilson, chairman of the board, Indiana Standard has reprints of two articles, one on refining technology and the other on oil from coal and shale.

Most of the papers were written under the stress of war to assure the rest of the industry, the public, and military and government officials that there was no need for great alarm concerning this nation's exhausting its petroleum reserves soon. There necessarily are some repetitions of statements on total resources with slight variation of statistics, but the contents appears quite convincing.

A most obvious subject that deserves careful study in estimating petroleum resources is "Technology—The Great Multiplier," which is covered in a chapter under that name. It is doubtful that the great extent of the meaning of this is more than hazily understood by the average layman—how an oil field may be pumped for months or years, then some new production method makes possible greater recovery from the same oil sand. Refiguring underground reserves, engineers find more barrels of producable oil than they calculated when the field was originally discovered.

Just what effect deeper drilling will have upon increasing our underground reserves is a matter for speculation, but A.P.I. technical committees have for sometime been studying specifications for heavier drilling equipment needed for 18,000 ft. wells, which is nearly 200 ft. deeper than the drill bit has ever gone. Results are likely to add materially to present underground reserves figures quoted in the book under review. In addition, there are constant improvements in refinery technology for cracking the last drop of products from raw crude, and coming better motors to obtain more miles per gallon.

The historical and statistical data on activities abroad show without egotism that American oil men lead the industry worldwide. They will continue to obtain a fair share of foreign oil if allowed freedom of movement by our government and are given capable backing by our State Department.

(*Our Oil Resources*, Edited by Leonard M. Fanning—McGraw-Hill, $4)

E. L.

## Synthetic Lubricants to be Described at SAE Meeting

NPN News Bureau

CLEVELAND—New types of synthetic lubricants, made from hydrocarbon gases but containing no petroleum oils, will be described during the opening sessions of the Society of Automotive Engineers annual meeting next Monday, Jan. 7, in Detroit.

Results of laboratory and road tests with the lubricants and details of their properties will be explained in the paper "New Synthetic Lubricants," to be presented at the afternoon meeting on Materials, and prepared by J. C. Kratzer, Linde Air Products Co.; D. H. Green, National Carbon Co., Inc.; and D. B. Williams, Carbide and Carbon Chemicals Corp.

Included in the other papers on the five-day program being held at the Book-Cadillac hotel, and of particular interest to oil men, are the following:

"Effect of Fuel Properties on (Diesel) Engine Performance" (Thursday, Jan. 11), F. G. Shoemaker, Detroit Diesel Engine Division, General Motors Corp. "Motor Oils—Regular, Premium and Heavy Duty" (Friday, Jan. 11), H. R. Wolf, Research Laboratories Division, General Motors Corp. "A Review of the Development of Reference Fuel Scales for Knock Rating" (Friday, Jan. 11), D. B. Brooks, National Bureau of Standards.

The complete program was printed in NATIONAL PETROLEUM NEWS, Dec. 19, 1945, page 38.

## Petroleum Production Pioneers Hold Annual Christmas Party

NPN News Bureau

LOS ANGELES—The Petroleum Production Pioneers held its annual Christmas Party Friday night Dec. 28 at the Elk's Club in Los Angeles.

This organization is dedicated to maintaining a bond between the experienced field men in the petroleum production industry and the younger men who hold the responsibilities of the industry and administration of this organization.

The officers for the next year are: president, J. E. Gosline, Standard Oil Co. of California; vice president, L. George Trembley, Howard Supply Co.; and secretary, R. Sneddon, *The Petroleum Engineer*.


**National Petroleum News**

Established February, 1909
Trade Mark Registered U. S. Patent Office

Published every Wednesday by
The National Petroleum Publishing Co.

WARREN C. PLATT
*Editor and Publisher*

A. E. KRAFT
*Treasurer*

V. B. GUTHRIE
*Associate and Technical Editor*

Y. A. KOSKINEN
*Advertising Manager*

Member
Audit Bureau of Circulation
and Associated Business
Papers, Inc.

PUBLICATION OFFICE
1213 West 3rd St., Cleveland 13, Ohio.
CHerry 7672

NEWS BUREAUS

NEW YORK COlumbus 5-1695
50 West 50th St., New York 20

WASHINGTON NAtional 3477
1034 National Press Bldg., Washington 4

CHICAGO HARrison 5901
59 East Van Buren St., Chicago 5

TULSA 3-7132
904 World Bldg., Tulsa 3

LOS ANGELES VAndike 4412
204 Hillstreet Bldg., Los Angeles 14

SAN FRANCISCO GArfield 7700
Finance Bldg., San Francisco 4

Subscription rate $5 per year in United States, Mexico and Pan-American Countries; $6.50 in Canada and Foreign Countries. Current copies 20 cents, except special issues; back copies more than two months old 30 cents per copy.

Cable Address: PLATTOIL, Cleveland, Ohio
Cable inquiries are answered by mail unless sufficient funds in American money are advanced for cabled reply.



Copyright 1945 by
The National Petroleum Publishing Co.


## Oklahoma Petroleum Motor Transport Election Is Set

NPN News Bureau

TULSA—A special meeting to elect officers of Petroleum Motor Transport Assn. of Oklahoma was scheduled Jan. 3, according to J. D. Ward, secretary-treasurer. The nominating committee was to present the following slate: for president, R. W. Randle, The Texas Co.; first vice president, C. J. Martin, Phillips Petroleum Co.; second vice president, J. M. Green, Olson Drilling Co.; secretary-treasurer, J. L. Avery, Adkins Oil Co.; and to serve on the board of directors, Omar Fincannon, Helmerich and Payne, Inc., R. E. Campbell, Sunray Oil Corp., and R. C. Hopper, Skelly Oil Co.

## Magnolia Construction Set

*Special to NPN*

MIDLAND, Tex. — Magnolia Petroleum Co. has announced that construction will be started soon on a $100,000 building here. All space in the two-story and basement building will be used for offices by Magnolia's Permian Basin land, geological and production departments and for the division offices of the Magnolia Pipe Line Co. Construction will be of brick, tile and concrete. The structure will be air conditioned.

# ABOUT OIL PEOPLE

**M. H. Arveson** has been appointed senior technologist in the recent formed chemical products department of Standard Oil Co. (Indiana). He has been with the company since 1927, first as a research chemist and group leader at the Whiting refinery laboratories and later as a member of the development and patent department. Active in local and national scientific groups, Mr. Arveson was manager of the National Chemical Exposition held in Chicago in 1944, and is now chairman of the Chicago section of the American Chemical Society.

**Dr. E. L. D'Ouville,** formerly a member of the research department, has returned to Indiana Standard after several years with the Mellon Institute and will take over Mr. Arveson's duties in the development and patent department.

♦ ♦ ♦

**Eugene McElvaney** of Dallas has been elected a director of the Tennessee Gas and Transmission Co. Mr. McElvaney is a vice president of the First National Bank of Dallas where he has charge of oil and gas loans. He is a director of the Texas Mid-Continent Oil and Gas Assn. and is affiliated with the Independent Petroleum Assn. of America and the American Petroleum Institute.

The North Texas Section of the American Institute of Mining and Metallurgical Engineers recently heard a lecture illustrated by color film showing the efforts made to discover oil in Northern Alaska. **L. W. MacNaughton** of the Dallas geological firm of DeGolyer & MacNaughton, was the speaker. Mr. MacNaughton's talk was supplemented with two reels of color sound film which showed progress of the entire project during its progress.

♦ ♦ ♦

Four new members from the petroleum industry have been elected by the Controllers Institute of America. They are: **Russell G. Bannister,** assistant treasurer of the Petrol Corp., Philadelphia; **Donald R. Boggs,** chief accountant of the Standard Oil Co. of Texas and **Hubert L. Smith,** vice president, secretary and treasurer of that company; and **Willis B. Oram,** secretary and controller of the Darling Valve & Manufacturing Co., Williamsport, Pa.

The institute is a technical and professional organization of controllers devoted to the improvement of controllership procedure.

**Miss Lavon Peters,** University of Kansas graduate, has joined the geological staff of the Gulf Oil Corp. in Fort Worth.

## Robert Price Russell to be Presented Gold Medal

NPN News Bureau

NEW YORK — The 1946 gold medal of the American Institute of Chemists "for noteworthy and outstanding service to the science of chemistry or the profession of chemist in America" goes to Robert Price Russell, Summit, N. J., president of Standard Oil Development Co. It will be presented at the institute's annual meeting here in May.

Announcing selection of Mr. Russell this week, Dr. Gustave Egloff of Chicago, institute president, said:

"Unanimous decision of the committee to bestow this honor upon you was made in recognition of your genius not alone as a chemist and chemical engineer but as an administrator. Your deep interest in the chemist and the chemical engineer and their profession is outstanding. Your contributions to the petroleum industry and the war effort are well and widely recognized."

Achievements of the central technical and research organization of Standard Oil Company (N. J.) under Mr. Russell's leadership have included the fluid catalytic cracking process for manufacture of 100-octane aviation gasoline, a process for synthesizing toluene for TNT from petroleum, and discovery of a catalytic process for making butadiene from petroleum for synthetic rubber.

During the war, Mr. Russell supervised groups in the Standard Oil Development laboratories working on improved weapons for the armed services in close collaboration with the Army, Navy, Chemical Warfare Service and the National Defense Research Committee. From this cooperative work came such weapons as the M-1 mechanical smoke generator, which creates a lasting oil fog; the M-69 aerial incendiary bomb used so widely on Japan, and improved flame throwers using jellied gasoline.

He was born in Worcester, Mass., in 1898, the son of a bank clerk. He attended Clark University in his home town and helped pay for his education with an assortment of jobs that included house-to-house selling of brushes.

After serving with the Marines in World War I, he resumed his education at the Massachusetts Institute of Technology, and continued there as assistant director of the research laboratory and as an assistant professor of chemical engineering after receiving his master's degree in 1923.

He joined the Jersey Standard company in 1927 and became president of the development company in 1944.

## COMING MEETINGS

**JANUARY**

**Society of Automotive Engineers,** Book-Cadillac Hotel, Detroit, Jan. 7-11.

**Oil & Heat Institute of America board of directors,** Commodore Hotel, New York, Jan. 8, 1946.

**North Carolina Oil Jobbers Assn.,** Raleigh, N. C., Jan. 9, 1946.

**National Aircraft Show,** Public Auditorium, Cleveland, Jan. 11-20.

**American Road Builders Assn.,** Stevens Hotel, Chicago, Jan. 14-17.

**Independent Petroleum Assn of America,** quarterly meeting of executive committee, Shreveport, La., Jan. 15, 16.

**American Trucking Assn.,** Netherlands Plaza Hotel, Cincinnati, Jan. 16.

**Oil Trade Assn. of Philadelphia, 33rd annual** banquet, Bellevue-Stratford Hotel , Philadelphia, Jan. 24.

**Northwest Petroleum Assn., Jan. 24-25, Nicollet** Hotel. Minneapolis, Minn.

**Independent Natural Gas Assn.,** Houston, Jan. 28.

**FEBRUARY**

**Petroleum Division of National Assn. of Credit Men,** Congress Hotel, Chicago, Feb. 11-13.

**Illinois Petroleum Marketers Assn. convention,** Hotel Pere Marquette, Peoria, Ill., Feb. 12-14.

**Kentucky Petroleum Marketers Assn. 20th annual** meeting, Brown Hotel, Louisville, Ky., Feb. 19-20.

**Missouri Independent Oil Jobbers Assn.,** Hotel Governor, Jefferson City, Mo., Feb. 19, 20.

**Iowa Independent Oil Jobbers Assn.,** Hotel Ft. Des Moines, Des Moines, Feb. 26-27.

**MARCH**

**Kansas Oil Men's Assn.,** annual convention, Broadview Hotel, Wichita, March 11-12.

**Ohio Petroleum Marketers Assn.,** annual convention and trade exposition, Hotel Deshler-Wallick, Columbus, O., March 12-14 (tentative).

**Indiana Independent Petroleum Assn.,** spring convention, Hotel Severin, Indianapolis, Ind., March 14-15.

**APRIL**

**Natural Gasoline Assn. of America, annual convention, Baker Hotel, Dallas, Texas, April** 17-18-19, 1946.

**National Petroleum Assn.,** Hotel Cleveland, Cleveland, O., April 18-19, 1946.

**Oil & Heat Institute of America Industry Exhibition,** Philadelphia, April 23-27, 1946.

**MAY**

**National Association of Corrosion Engineers, President Hotel, Kansas City, May 7, 8, and 9.**

**National Oil Scouts & Landmen's Assn.,** Jackson, Miss., May 16-18, 1946.

**SEPTEMBER**

**Chicago Section, American Chemical Society,** Coliseum, Chicago, Sept. 10-14.

"Jobbers! . . . I'll give Your Business a Big Lift, too! . . .

# War-Proved Flying Horsepower!"

**War's Greatest Gasoline Development now pulling Customers to Mobilgas Dealers!**

NEW Mobilgas means great new "power-pull" for dealers as well as motorists. For millions are learning—via newspapers, magazines and radio—that *Flying Horsepower* is the result of the same power ingredients that go into 100 Octane aviation gasoline.

They're learning, too, that it lives up to advance claims . . . delivers instant throttle response, super-fast get-away, surging power.

Result: Big jobber profits—big dealer profits! Never before has a symbol illustrated its product's claims so graphically. Nor has any previous symbol established such close identification of product with dealer.

SOCONY-VACUUM OIL COMPANY, INC.

**BIG NEW ATTRACTION at Mobilgas Dealers' . . .**

# NEW Mobilgas

## *GIVES FLYING HORSEPOWER*

*The Flying Horsepower you get from New Mobilgas results from the same ingredients that gave the superior Fighting Power to our 100 Octane Aviation Gasoline.*

TUNE IN "INFORMATION PLEASE"—MONDAY EVENINGS, 9:30 E.S.T.—NBC

Mobilgas
SOCONY-VACUUM

NEW YORK 4, N.Y.—26 Broadway • CHICAGO 5, ILLINOIS—59 E. Van Buren St. • BALTIMORE 2, MARYLAND—10 Light St. • MILWAUKEE 1, WISCONSIN—907 South First St. • CLEVELAND 15, OHIO—1422 Euclid Avenue. • KANSAS CITY 6, MISSOURI—925 Grand Avenue. • DETROIT 32, MICHIGAN—903 West Grand Blvd. • ST. LOUIS 8, MISSOURI—4140 Lindell Blvd. • DALLAS 1, TEXAS—Magnolia Petroleum Co., Magnolia Building.

Socony-Vacuum maintains many other conveniently located service offices to give you close and fast cooperation.

A NEW YEAR. Gasoline is back. Motoring is back. And, yes, *competition* is back! New stations, new openings, new men in the business...

Have you made adequate plans to get your share of gasoline business in this first full year of return-to-normal? Let part of your plan include the Gilbarco "96" Calco-Meter. It's the modern station pump that combines eighty years of experience with top-flight engineering and quality materials, to bring you dependable operation and extra-long service ... and bigger gasoline profits all the way!

To make sure of your share of new gasoline business ... put Gilbarco "96" Calco-Meters on your station islands. They're more than an improvement, they're a business investment!

ARMY E NAVY

Gilbarco

GILBERT & BARKER MFG. CO.
West Springfield, Mass. • Toronto, Canada

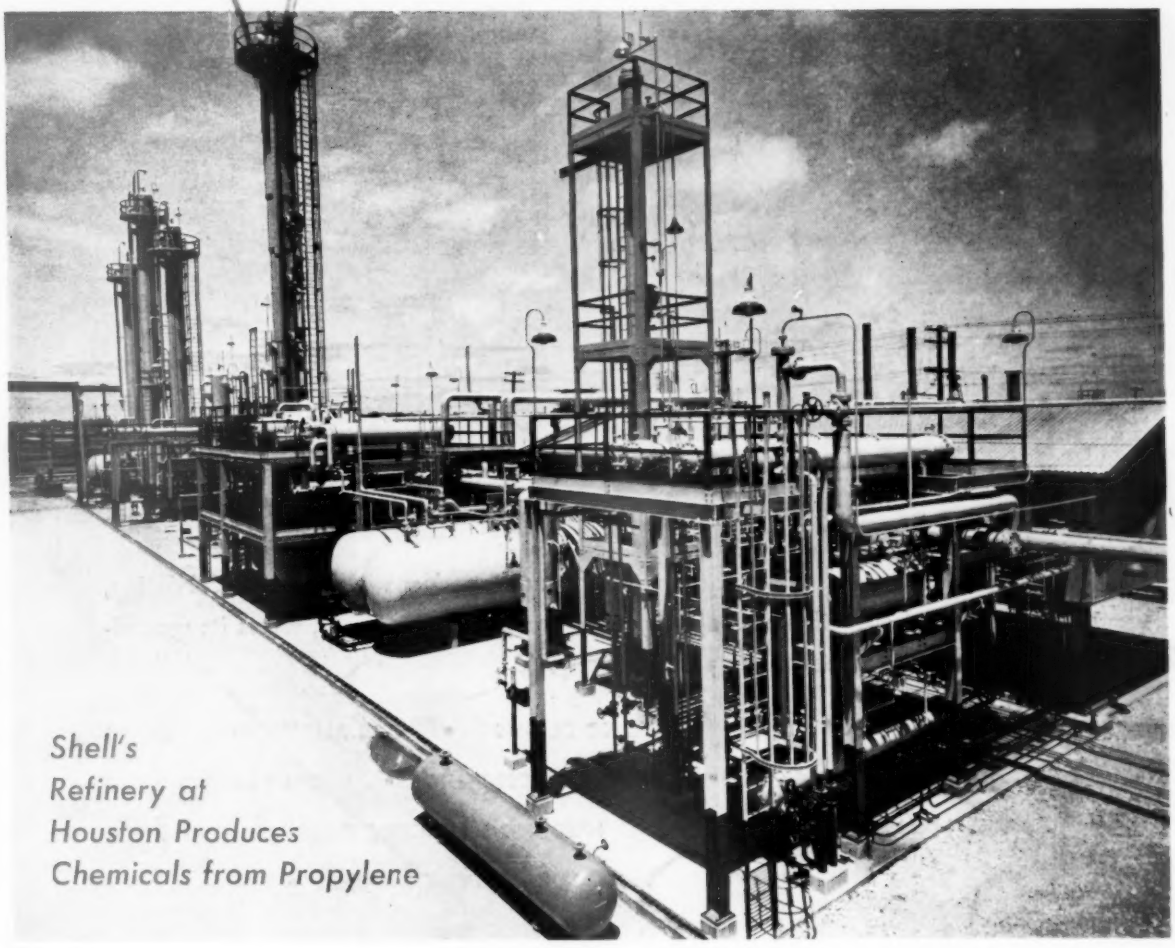
TECHNOLOGY DEPT.
JAN 9 1946

NATIONAL PETROLEUM NEWS

Monthly Technical Section Devoted to

# REFINERY MANAGEMENT and PETROLEUM CHEMICAL TECHNOLOGY

Section Two | January 2, 1946 | Vol. 38, No. 1



*Shell's Refinery at Houston Produces Chemicals from Propylene*

First plant in the U. S. to produce allyl chloride, and the second to make allyl alchohol, from propylene is the Deer Park refinery at Houston of Shell Oil Co. The chlorination unit is back of the propylene storage tanks in the center of the picture

**Peacetime Outlook for Petrochemicals** ..... **Pg. R-3**

*NPN Technical Section Reports First Hand on the Conversion Program of the Chemical Manufacturing Industry in the Southwest*

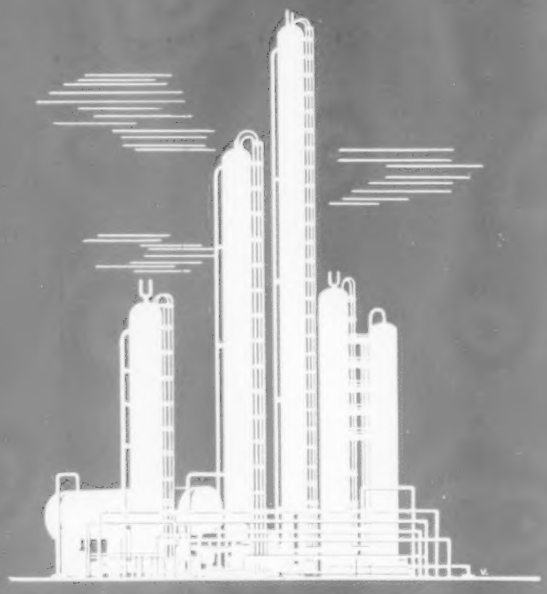
---

*OTHER FEATURES IN THIS ISSUE*

**Waste Disposal**—Why Petroleum Refiners Must Face This Problem Now ..... **R-11**

**Metal Corrosion**—How One Refiner Predicts Still Tube Failures ..... **R-17**

**Petroleum Solvents**—New Types of Aromatic Naphthas Meet Increasing Needs ... **R-65**



THE HUDSON organization, qualified by years of experience in the successful design, construction and operation of major hydrocarbon processing plants, offers its specialized services for projects in any part of the world.

**GAS COMPRESSOR STATIONS • CYCLING PLANTS • GAS DEHYDRATION PLANTS • NATURAL GASOLINE PLANTS • FRACTIONATION UNITS • CRUDE TOPPING UNITS • PRESSURE MAINTENANCE PLANTS • HYDROGEN SULPHIDE REMOVAL PLANTS • • ATMOSPHERIC AND VACUUM DISTILLATION UNITS •**

# HUDSON
## ENGINEERING CORPORATION

*Engineers & Constructors*

FAIRVIEW STATION • HOUSTON, TEXAS

# Contents

**National Petroleum News, TECHNICAL SECTION**

**Vol. 38, No. 1 — Jan. 2, 1946**

## FEATURES

★ Petrochemical Industry in the Southwest Builds for Growing Peacetime Markets ..... R-3
*By D. P. Thornton, Jr.*
Mass Consuming Markets Forecast for New Petrochemical Products ..... R-8
★ Simple Device Saves 51 Hours in Maintenance of Compressors ..... R-10
★ Disposal of Petroleum Refinery Wastes
Article 1—Industry's Relation to the Problem ..... R-11
*By W. B. Hart*
★ Study of Corrosion Pattern in Still Tubes Results in Reduction of Metal Losses ..... R-17
*By William F. Kramer*
★ TAC Finale Is on a Note of Victory ..... R-25
Peace-Time Utility of War-Time Petroleum Refining Processes ..... R-27
*By F. D. Parker*
★ Nomograph for Calculation of Olefin Conversion in Catalytic 'Poly' Plant ..... R-33
*By Elwood G. Glass, Jr.*
★ Oil Shale Retorting ..... R-36
*By J. W. Payne, C. H. Lechthaler and E. V. Bergstrom*
★ Careful Utilization of Non-Technical Personnel 'Stretches' Supply of Technical Workers ..... R-42
★ Study of Tower Plate Hydraulics Made with Air and Water Tests ..... R-43
Utilization of Natural Gas in U.S. ..... R-46
*By G. G. Oberfell*
Half of 34-Mile Pipeline Is Laid Under Water ..... R-53
Securing and Presenting Foundation Design Data ..... R-57
*By Trent R. Dames*
★ Improved Petroleum Naphthas and Solvents are Finding Many New Industrial Uses ..... R-65
*By B. H. Weil and Fred B. Loeffler*
Output of Chemicals from Oil Up, U. S. Report Shows ..... R-70

## DEPARTMENTS

New Books for the Refiner ..... R-22
★ Industrial Lubrication ..... R-56
*By W. G. Forbes*
★ Patent Trends in Petroleum Refining ..... R-71
*By Peter J. Gaylor*
★ Keeping Up With the News ..... R-74
Petroleum Technologists in the Headlines ..... R-78
★ Widening Horizons ..... R-80
*"Kilgore Presents a New Draft of His Research Program Bill"*
*"Postwar Competitive Era Brings New Plant Operating Problems"*

★—EXCLUSIVE in this issue of the NPN TECHNICAL SECTION

Published Every Month by

**The National Petroleum Publishing Company**

Publication Office, 1213 West Third Street, Cleveland 13, Ohio, U. S. A.

V. B. Guthrie, Editor, Technical Section

D. P. Thornton, Jr., Assistant Editor • William F. Bland, Engineering Editor

# PREVIEW
## OF FEBRUARY FEATURES

### *Inhibitors Prevent Corrosion Of 18-8 Furnace Tubes*

Failure of 18-8 alloy furnace tubes in a superheater furnace, the result of severe corrosion on the hydrocarbon side of the tubes, was experienced in one refinery after only 120 hours operation. Subsequent investigations by the engineers of two oil companies revealed that the addition of small amounts of sulfur or water to the charge stock served to inhibit the corrosion, even to the point where no measurable corrosion of the tubes is now apparent.

The detailed results of their studies and findings are presented in their report, in the February issue of the TECHNICAL SECTION.

### *Federal and State Laws Which Affect Waste Disposal*

**(Second article of a series)**

Laws to control or eliminate the pollution created by the indiscriminate disposal of industrial wastes have been enacted by the federal government and most of the states. The applicability of these laws to refiners, and the extent of the control invested in the various authorities which administer them will be described next month in the second of W. B. Hart's series of articles on waste disposal.

Mr. Hart, in charge of waste disposal for the Atlantic Refining Co., Philadelphia, has written this series exclusively for the NPN TECHNICAL SECTION. The first article appears in the current issue (page R-11) and describes the refiners' relation to the problem of disposing of their wastes.

### *Maintenance and Repair Of Refinery Instruments*

To assure that its instruments are kept in dependable working condition, one major oil company has set up a complete Instrument Department, which handles the inspection, maintenance and repair of over 3000 instruments and control mechanisms. The organization and work of that department, from foreman down through apprentices, is described in detail in the February TECHNICAL SECTION by the department supervisor.

### *Yearly Index*

The two semi-annual indices of articles appearing in the NPN TECHNICAL SECTION during 1945 are being combined into a single yearly index, covering the full 12 issues and giving a complete subject and author listing of all material published during the year. Copies of this index may be obtained, without charge, upon request to the Technical Editor, National Petroleum News, 1213 West Third St., Cleveland 13, Ohio.

**ETHYL CORPORATION**

# ● research laboratories

**1600 West Eight Mile Road, Detroit**

With removal of wartime restrictions, the Ethyl Corporation is now able to extend a cordial invitation to its friends to visit its new research laboratories at 1600 West Eight Mile Road, Detroit.

Designed specifically for research and development on the interrelated problems of gasoline engines, fuels and lubricants, these new laboratories have much in the way of special equipment and unique features which make them interesting to technical people in both the automotive and petroleum industries.

**ETHYL CORPORATION, CHRYSLER BUILDING, NEW YORK, NEW YORK**

REFINERY MANAGEMENT *and* PETROLEUM CHEMICAL TECHNOLOGY

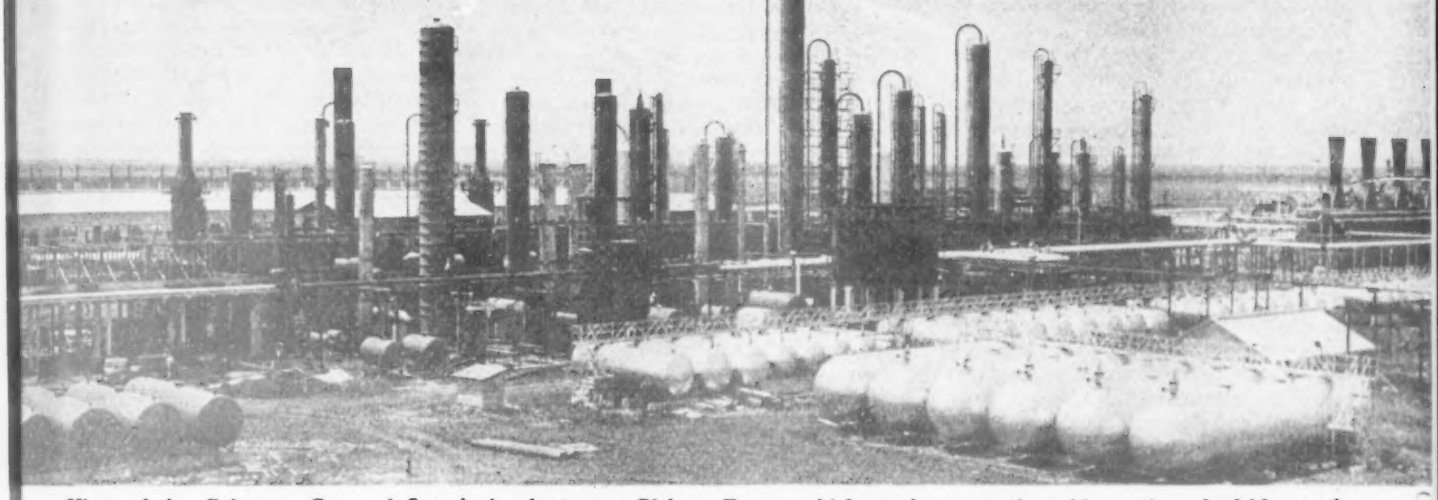
Jan. 2, 1946
Volume 38
Number 1

MONTHLY TECHNICAL SECTION OF NATIONAL PETROLEUM NEWS *incorporating International Petroleum Technology*

# Petrochemical Industry in the Southwest Builds for Growing Peacetime Markets

*By D. P. Thornton, Jr.*

*Assistant Editor, NPN Technical Section*



**View of the Celanese Corp. of America's plant near Bishop, Texas, which produces acetic acid, acetic anhydride, methanol, and other chemicals from butane and propane. The extensive storage required for the charge stocks is shown in the foreground**

## Continued and Increasing Manufacture of Chemicals from Petroleum Is Forecast; Mass Tonnage Demands Seen for Some Products

THE impetus to the manufacture of chemical products from petroleum, natural gas and refinery gases which the war brought to the southwest, Texas in particular, will continue in the peacetime years.

This statement is based on first hand observations from visits to many of the plants and interviews with various authorities by this writer. The object of his survey was to learn what is being done with, and planned for, these new type processing facilities of various petroleum refiners and chemical manufacturers since the war demand for their products ended.

Some authorities even see in the more distant future a mass tonnage demand for some of these recently developed synthetic compounds, for fabrics, plastics, building materials and other so far unexploited uses. If it eventualizes this would create an industrial demand for chemicals on a mass volume, low cost basis hardly even dreamed of at present.

In such event the southwest might become the center of chemical manufacturing for the U. S., since petroleum and gas reserves offer large volumes of low cost raw materials for these processes. It is also likely that companion and complementary fabricating and manufacturing concerns would be attracted to the southwest, to further swell this new industry.

Excluding already well known investments in butadiene and synthetic rubber plants, although the former is a chemical produced in 99% purity and better, plant investment in Texas for the manufacture of petroleum derived chemicals will be way over $100,000,000 by the middle of 1946.

Humble Oil & Refining Co., Magnolia Petroleum Co., Pan American Refining Corp., and Shell Oil Co. Inc., all made nitration grade toluene in their refineries during the war. In some instances these facilities will continue to make this material for sale as a solvent or chemical intermediate. In others the equipment will be used to make a high-octane blending stock for aviation and motor gasolines.

Carbide and Carbon Chemicals Corp., Celanese Corp. of America, Dow Chemical Co., Monsanto Chemical Co. and Shell Chemical Co. (of Shell Oil) are all operating plants, some government-owned, to manufacture a long list of synthetic organic chemicals, intermediates and plastics derived at least in part from natural gas.

The Shell chemical plant is the first in the country to produce allyl chlorides in commercial quantities and the second to produce allyl alcohol. Allyl chloride is a product of the chlorination of propylene. Some of the allyl chloride derivatives were important war materials, one of the best known being cyclopropane, a relatively new type of anaesthetic gas. They can also provide many peacetime chemicals, including acetone, used in the manufacture of plastics, synthetic

fabrics and other new materials. Allyl alcohol is the base of a new group of resins which are fundamentally a new type of plastics. Reacting with other materials, it forms a liquid which will harden under the influence of heat and a peroxide catalyst into clear, transparent solids, without the aid of the high pressures needed in forming other plastics.

E. I. du Pont de Nemours & Co. is building two plants in the Houston-Beaumont area to cost over $31,000,000. Neither is expected to use petroleum products as raw materials "immediately", according to a statement by this company. However, the statement continues:

"The readily available supply of hydrocarbon materials in the Texas area and the clear possibilities for their (petroleum products) use later in both of the chemical processes was one of the big reasons for choosing Texas. Another was the easy access to water transportation. A third factor was that in both places there is plenty of room for expansion."

The styrene plant operated by Monsanto was located, according to the company, "because of deep water facilities, cheap and abundant fuel, a good labor supply and a climate favorable to open-type outdoor installations." Still others have pointed out that locations in the southwest were chosen because refinery gases are available in large quantities, as well as such necessary raw materials as sulfur, sea-water brines, common salt and other minerals.

Jefferson Chemical Co., subsidiary of The Texas Co. and American Cyanamide Co., has announced plans to build a large chemical plant adjacent to Texaco's asphalt plant at Port Neches. Using refinery gases, products will include intermediate chemicals for the manufacture of synthetic rubber, plastics, textiles and other materials. At the same time, American Cyanamide will construct a plant adjoining Jefferson on the east which will use some of the products manufactured by Jefferson for raw materials. Approximately 2000 acres of land are involved in the two tracts, which front on the Neches River.

It also has been reported that a $15,000,000 Fischer-Tropsch plant is being considered for the Panola gas field of Panola County, Texas (E. S. E. of Dallas on the Texas-Louisiana line). It is stated that such a plant can manufacture gasoline from 5c per mcf gas competitive with conventionally-produced gasoline from $1 crude. It would also produce chemicals, among them formaldehyde, methyl alcohol and acetone, plus solvent mixtures containing two or more of these compounds. The operating company is said to be Carthage Hydrocol, Inc., owned by several oil companies and Hydrocarbon Research, Inc., of New York. It is reported that this proposed Carthage plant will produce 5000 b/d gasoline testing better than 80-octane number, 1000 b/d Diesel fuel and 200,000 lbs. per day of crude alcohols (methyl and ethyl) and acetone.

The list of chemicals from these Texas plants is as imposing as the figures on plant investment. Among them are: acetylene, acetone, acetic acid, acetic anhydride, ammonia, ethylene, ethylene dibromide and dichloride, ethylene and diethylene glycols, ethyl alcohol, formaldehyde, allyl alcohol and its derivatives including the halides, nitriles and amines, hexachlorethane, and styrene.

Table 1 (page R-6) is a list of the more important chemical plants in the southwest which derive their raw materials in whole or part from petroleum. The reader should bear in mind that the list of chemicals, while based on the best information obtainable, is not official and probably not complete since several of the chemical companies failed to supply data on raw materials and products. The map on page R-7 gives the approximate location of the plants listed in Table 1.

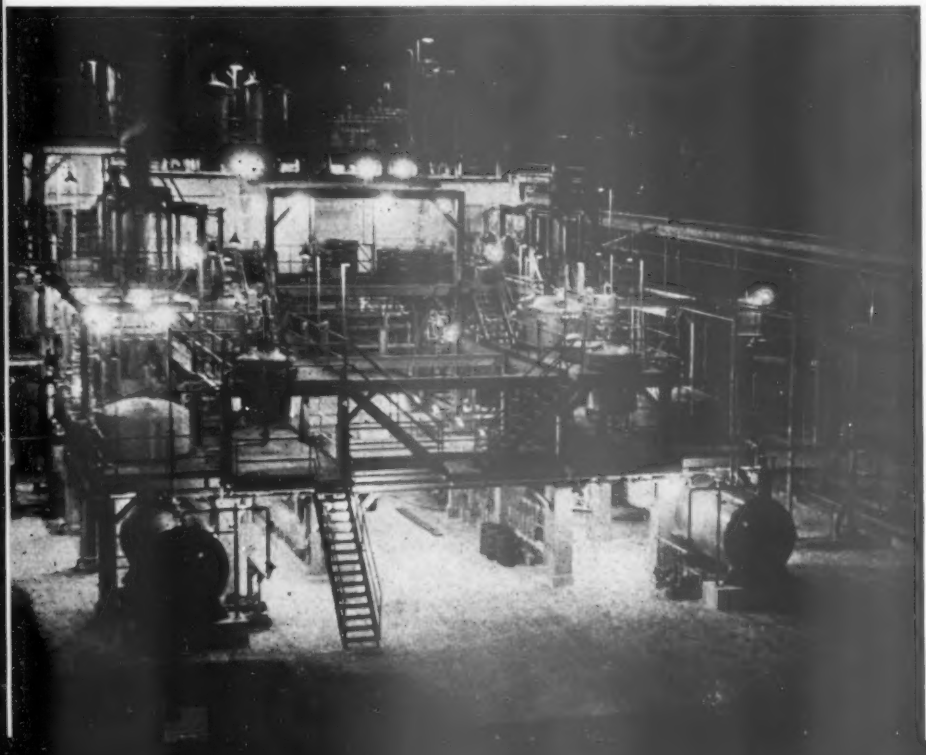
The raw materials from which these chemicals will be made includes natural gas (methane), ethane, propane, butylenes, and methyl- or dimethylclohexane. Three plants near Houston on which estimated takings are available include Monsanto and Carbide, both at Texas City, each of which reportedly uses 80,000 gal. of ethane-propane mixture daily. Monsanto's supply comes from nearby cycling plants, while Carbide's is piped from the refinery of Pan-American Refining Corp. near by. Dow Chemical, at Freeport, is said to receive approximately 65,000 gal. daily of ethane-propane mixture by pipeline from the Katy Cycling plant of Humble Oil & Refining Co.; it is believed takings can be increased to over 100,000 gal. if need be.

Lest the volume of products used as raw materials for chemicals manufacture should seem disappointingly small to petroleum industry leaders it should be remembered that 100,000,000 lbs per year is an extremely large rate of production for a chemical product. In this connection, H. D. Wilde[1] has made the following statement:

"The yield of any one chemical product per barrel of crude is small but the yield of other commercial products—gasoline, kerosine, fuel oils, lubricants, and so on—is large. Hence large volumes of crude must be processed, the chemical manufacturing operations being carried on in conjunction with normal refining operations in order to provide an outlet for the other products made simultaneously.

"No one in his right mind would undertake to build a plant exclusively for a chemical product such as alcohol, butadiene, or ethyl chloride, using crude as a raw material. True, some plants use propane as the raw material solely for the production of synthetic chemical products, but the propane used is obtained from a refinery, a natural gasoline plant or a cycling plant, where the propane is one of the products obtained from an operation conducted primarily for other purposes."

Generally speaking, these users of petroleum products for chemicals manufacture are very coy about what they are doing, laying their reticence to its being a very keenly competitive industry. Many will not, for example, give even generalities about the processes em-



**Monsanto's Texas City styrene plant cracks propane to ethylene, which is combined with benzene to form styrene. The open, outdoor construction of the plant, shown in this night view of the reactor section, has earned for it the name of "battleship"**

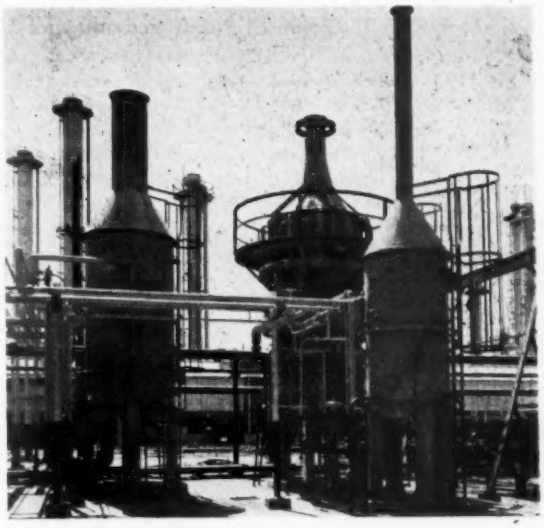
ployed in their syntheses or identify individual plants' products, despite the fact that their processes are as open to patent protection as those of any other industry. By inspection from the highway or plant gate, the plants may or may not bear any resemblance to a refinery, although some indeed look much like a gasoline plant.

In the chemical industry the investment cost per unit of product is usually much larger than in a refinery. This is a necessary corollary of high degree of product purity. Many of the operations require exceedingly close control, demanding either a large number of operators and technicians, a considerable investment in automatic control devices and suitable laboratory equipment, or both. They involve fractionations under high vacuum, and not a few attain desired purities of product through azeotropic distillations of varying complexity. Other frequently-used procedures involve separations by precipitation from solution or by repeated fractional crystallizations.

Such processing—much of it entirely foreign to conventional oil refining—is perhaps the basis for the not-infrequently heard comment to the effect that the oil industry will lose its shirt if it attempts to "invade" the chemical manufacturing field. In fact, the manager of one large chemical plant stated that several successful chemicals-from-petroleum ventures were being carried out with the chemical industry supplying the "know-how" and oil industry the money. Moreover, he said the oil companies may find that a lot of the ground they have just scratched has already been well-plowed by the chemicals industry; they will have to learn "the hard way" what the chemical manufacturers have already learned.

On the other hand, the petroleum refiners point out they now provide butadiene for more than half our present synthetic rubber production, and that synthetic toluene manufacture constituted this country's major source of this important raw material for explosives manufacture. Several oil companies were engaged in chemicals manufacture before the war and one (Shell) has recently built a $1,000,000 allyl alcohol and chloride plant in Texas. All these companies show every intention of continuing their chemical manufacturing activities and, moreover, scrutiny of patent surveys shows continuing interest from oil companies large and small in research work in this field.

Oil men now in the chemicals business point out that any company intending to enter this highly competitive field should look carefully at its "hole card", bearing in mind that much expensive equipment must be installed and its products profitably disposed of. By-products, which inevitably are a part of most chemicals production, must also be profitably utilized or sold. The market, they caution further, has been historically small-volume when compared to oil marketing. The pricewise effect of large volumes of a product on such a market must be carefully studied.



**View of heaters at Shell's $1,800,000 chemical plant at Houston, the first plant in the U. S. to produce allyl chloride from propylene. All three furnaces are gas-fired, with temperatures automatically controlled. Furnace at right is 4.5 ft. in diameter, has 1.5 in. tubes, and is used to preheat the feed stock. Left-hand furnace is 6 ft. in diameter, has 3 in. tubes, and vaporizes feed. Center furnace, 6.5 ft. in diameter with 3 in. tubes, is not identified as to its part in the process**

These authorities at present do not believe every refinery in the U. S. ever will enter or want to enter chemicals manufacture even on a small scale, because of unfavorable transportation due to location. In all likelihood there will be a considerable increase in chemicals produced from petroleum by oil refiners. However, the large plants will more likely engage in this activity because:

(1) Their financial structure is such they can more easily "weather" adversities in production or marketing as well as provide the large initial investment,

(2) Their research investigations already are far along as evidenced by patent literature, and

(3) Many petrochemical raw materials constitute only a small portion of each barrel of crude and large refineries will have proportionately more to draw from than small plants.

Some authorities believe the oil industry will content itself largely with producing the basic product rather than basic product plus a host of derivatives. In a few cases oil companies will follow this latter course—already are, in fact—but in the main further synthesis will be left to the chemical companies because of the smaller individual volumes involved.

For example, it is one thing to manufacture formaldehyde, acetone, methanol or ethanol, toluene and xylenes, but quite another to produce formaldehyde resins, acetates, vinyl chlorides, amines and nitriles, plus TNT and other aromatics.

A prominent oil industry consulting engineer believes the market for plastics and plastics intermediates is being vastly over-rated as far as the oil industry is concerned.

The large and well known manufacturers, such as American Cyanamide, Carbide and Carbon, Dow Chemical, Celanese Corp., du Pont and Monsanto, already have the plants, markets and the know-how; the plastics market is not unlimited, he says.

He further points to the many possibilities for chemicals manufacture as by-products from the Fischer-Tropsch process. Study of the best features of the German plants, plus research in this country will make this process competitive with conventional refinery production of gasoline. By-products can be converted relatively cheaply into chemicals and thus make Fischer-Tropsch gasoline and gas oils still more competitive with similar products from petroleum, in this engineer's opinion.

With all respect to these opinions, there are two possible avenues for at least certain of the smaller refiners to get into chemicals manufacture, aside from some small-scale variation upon Fischer Tropsch or Synthene processes which may be developed to produce a high-octane blending stock without recourse to catalytic cracking of petroleum oils.

The most obvious, and probably most likely, is through controlled oxidation of methane and ethane. Cities Service Oil Co. has been marketing acetone, formaldehyde, methanol and solvent mixtures resulting from the controlled oxidation of "wet" natural gas for 17 years, in connection with the operation of a small gasoline plant at Tallant, Okla., not far from Tulsa.[2] As in any chemical venture, however, the effect of increased production of these materials on the existing market in terms of price, profits and transportation costs must be carefully evaluated.

The second is the possibilities inherent in the extraction, from refinery sludges and other wastes, of such chemicals and chemical intermediates as hydrogen sulfide, the mercaptans, organic polysulfides, petroleum sulfonic acids and allied products. Vanadium, for example, has been extracted from asphalts by the Russians, according to a survey of foreign literature by J. G. Tolpin[3], Universal

## TABLE 1—Chemical Plants in Southwest Using Petroleum Hydrocarbons in Synthesis of Organic Chemicals

| Plant & Location | Products | Estimated or Actual Plant Investment, $ | Petroleum-Hydrocarbons as Raw Material |
|---|---|---|---|
| ***Texas*** | | | |
| **Beaumont:** | | | |
| Magnolia Petroleum Co. | Toluene | | Methylcyclohexane from hydroforming |
| **Port Neches:** | | | |
| Neches Butane Products Co. | Butadiene | 58,700,000 | Refinery butylenes |
| Jefferson Chemical Co. | Textile & Plastics intermediates—plant to be built | 20,000,000 | Refinery gases |
| American Cyanamide | Same as Jefferson—plant to be built | ..... | Products from Jefferson |
| **Orange:** | | | |
| Dupont | Nylon "salt"—adipic acid, hexamethylene diamine—plant under construction | 28,800,000 | Methane (for hydrogen)* |
| American Viscose | Nylon, rayon (fibre)—plant to be built | ..... | ? ? ? |
| **Houston:** | | | |
| Shell Chemical Div. of Shell Oil Co. (3 plants) | Toluene, allyl alcohol, allyl chloride and other derivatives, agricultural chemicals | Toluene (2 plants): 1,000,000<br>Chemicals: 1,000,000 | Hydroformer naphtha; ethylene from refinery gases<br>Propylenes |
| Diamond Alkali Co. | To build plant. Products unspecified and may not use petroleum hydrocarbons | ..... | ? ? ? |
| Sinclair Rubber Co. | Butadiene | 31,500,000 | Refinery butylenes |
| Eastern States Petroleum Co. | Butadiene | ..... | Refinery butylenes |
| **Texas City:** | | | |
| Carbide & Carbon Chemicals Corp. | Acetone, acetic acid & anhydride, acetylene, ethanol, ethers (unspecified), ethylene dichloride & derivatives, ethylene & diethylene glycols, methanol | 15,000,000 | 80,000 gal/day ethylene from refinery gases (propane) |
| Monsanto Chemical Co. | Styrene—also some by-products | 19,000,000 | 80,000 gal/day ethylene from ethane-propane mixture |
| Pan-American Refg. Corp. | Toluene, xylenes, aromatic solvents | ..... | Methylcyclohexane from hydroforming |
| **La Porte:** | | | |
| Du Pont | Agricultural chemicals—plant under construction | 2,500,000 | May use petroleum hydrocarbons later |
| **Freeport & Velasco:** | | | |
| Dow Chemical Co. (2 plants) | Carbon tetrachloride, cumene, ethylene dichloride & derivatives, ethylene & diethylene glycols, ethylene dibromide & derivatives, hexachlorethane, styrene, thiokol synthetics, toluene | 46,000,000 | 1500-b/d ethane-propane mixture |
| **Baytown:** | | | |
| Humble Oil & Refg. Co. | Toluene, butadiene, butyl rubber | Butadiene: 19,400,000<br>Butyl rubber: 26,000,000 | Hydroformer naphtha<br>Refinery butylenes |
| **Bishop:** | | | |
| Celanese Corp. of America | Methanol, acetone, acetic acid, acetic anhydride, formaldehyde, acetaldehyde | 7,750,000 | Propane and butane |
| **Ingleside:** | | | |
| Humble Oil & Refg. | Butadiene (impure) | 4,100,000 | Refinery butylenes |
| Taylor Refg. Co. (Port Isabel) | Butadiene (impure) | 1,800,000 | Refinery butylenes |
| **Etter:** | | | |
| Cactus Ordnance Works (Shell Chemical Co.) | Anhyd. ammonia, aviation gasoline component | ..... | Natural gas |
| **Borger:** | | | |
| Phillips Petroleum Co. | Pure hydrocarbons (by fractionation), butadiene, carbon black | Butadiene: 3,501,000<br>Balance not available | Petroleum naphthas & liq. pet. gases<br>Butylenes<br>Natural gas |
| ***Oklahoma*** | | | |
| **Tallant:** | | | |
| Cities Service Oil Co. | Methanol, acetone, formaldehyde, solvent mixtures | ..... | "Wet" natural gas |
| **Ponca City:** | | | |
| Continental Oil Co. | Toluene, xylenes | ..... | Hydroformer naphtha |
| ***Kansas*** | | | |
| **Galena:** | | | |
| Jayhawk Ordnance Works (Military Chemical Wks. Inc.) | Anhyd. ammonia, nitric acid, ammonium nitrate solution | 30,000,000 | Natural gas |
| ***Arkansas*** | | | |
| **El Dorado:** | | | |
| Lion Oil Co. | Butadiene (impure) | 2,300,000 | Refinery butylenes |
| Ozark Ordnance Works (Lion Oil Co.) | Anhyd. ammonia, nitric acid ammonium nitrate solutions | 30,000,000 | Natural gas |

* Perhaps cyclohexane from light naphtha later.

Oil Products Co., and other developments along this line should be closely watched, especially in reports of Nazi developments discovered by our oil technical commissions.

No little speculation has been current on what will become of the government and privately-owned petroleum chemical plants constructed during the war. These, more particularly, may be classified as styrene, butadiene, synthetic rubber and toluene plants. At present only the toluene plants and some high-cost producers of butadiene have been declared surplus and placed with RFC for disposal. Of these, some of the toluene plants are being operated under interim lease pending negotiations for outright purchase. Of the butadiene plants, none are in leased operation for other purposes as far as can be learned.

A considerable amount of superfractionating equipment is a necessary adjunct of toluene-from-petroleum manufacture, also solvent extraction equipment, and catalytic hydroforming equipment. Owners of several of these plants believe they can be profitably operated for the manufacture of toluene and xylenes for the peacetime market, either for ultimate consumption as such or as intermediates for further chemical synthesis. Combinations of these materials also can be sold as aromatic solvents. The units also can be used to produce high-octane blending components for aviation and automotive gasolines. Fractionating equipment thrown out of use in such instances can be utilized for other refinery fractionation needs.

It is believed that many of the styrene plants will continue to be operated in peacetime — after natural rubber supplies become freely available — either in continued synthetic rubber manufacture or else for plastics. Polystyrene, marketed under several trade names as a plastic, had many important industrial uses before the war; doubtless this will not be diminished in the near future. Moreover, like most chemical plants, they have as available raw materials for other chemical synthesis such compounds as ethylene and ethylbenzene, which are starting points for a long list of derivatives of varying complexity.

It is believed that the butadiene plants particularly can be inexpensively converted to diverse chemical manufacturing. Most of them are well equipped with facilities for superfractionation, solvent extraction and catalytic dehydrogenation. They can easily convert to manufacture of other synthetic chemical products even if butadiene has no great industrial future other than as synthetic rubber, many authorities believe.

Many of the chemical processes used in these chemicals from petroleum plants, regardless of the raw material used, really start from acetylene, ethylene, acetic acid, formaldehyde, bromine and chlorine. All but bromine and chlorine can be derived from petroleum. Acetylene may be produced by severe thermal cracking of petroleum fractions or may be produced by cracking ethane in a regenerative furnaces as by the Wulf process[4]. Still another process now in course of development at the University of Texas makes acetylene in a "cold" electric arc from ethane; the Germans apparently had a similar process[5].

Ethylene is perhaps easiest secured by "cracking" propane at high temperatures: methane is a by-product. It also may be produced by the catalytic dehydration of ethyl alcohol. Incidentally, ethyl alcohol is produced by the addition of one molecule of water to

ethylene; one method of commercial importance is to absorb ethylene in sulfuric acid, then add water. Alcohol results from the hydrolysis. Instead of hydrolyzing to produce ethyl alcohol, if ethyl alcohol is added to a heated mixture of ethyl alcohol and sulfuric acid (actually ethylsulfuric acid), "ether" (ethyl ether) will be formed. If a "catalyst", aluminum sulfate, is added, no by-products will be formed and reaction temperature will be lowered. Ethyl alcohol in turn may be oxidized to acetaldehyde, which in turn may be oxidized to acetic acid.

When propane is cracked to produce ethylene, some propylene also is formed. By a similar procedure to that for ethylene, propylene added to sulfuric acid and then hydrolyzed yields isopropyl alcohol, another important solvent and chemical intermediate. Subjected to oxidation in the presence of powdered copper, isopropyl alcohol yields acetone which is important industrially as a solvent and also can be oxidized to acetic acid.

In the Texas styrene plants operated by Dow Chemical and Monsanto, ethylene is used with benzene to make styrene. Ethylene is derived by cracking of propane while benzene comes from the coke ovens of Pittsburgh, Birmingham and Chicago by barge.

In the Dow styrene process benzene and ethylene are alkylated with an unspecified catalyst to form ethylbenzene. This product is fractionated, overhead being recycle benzene and bottoms being recycle polyethylbenzene. The purified ethylbenzene taken off as a sidestream is mixed with steam and catalytically dehydrogenated to styrene. The impure product again is fractionated, with recycle benzene, recycle ethylbenzene and toluene appearing as overhead products; tar and styrene as bottoms. A final fractionation drop out tar.

Monsanto states that their Texas City plant cracks propane to ethylene at high temperatures, combining the resultant with benzene in a Friedel-Craft reaction. This would infer, from the classical literature, that aluminum chloride is used as the catalyst. The ethylbenzene formed is subsequently dehydrogenated by high-temperature catalytic reaction to styrene, which then is distilled in vacuo under careful control.

The synthesis of butadiene from butane and butylenes is too well known to require explanation here.

Acetylene or ethylene can be used in making vinyl chloride or vinyl acetate, the intermediates for the production of vinyl resins. Acetylene also may be catalytically combined with water to produce acetaldehyde, and further catalytically oxidized to form acetic acid.

Ethylene, converted to ethyl chloride, together with sodium hydroxide may be reacted with cellulose to form ethyl cellulose. This is an important plastic. Vinylidene chloride, prepared from ethylene and chlorine, is polymerized to form the widely utilized plastic "Saran", marketed by Dow Chemical.

The list of possible syntheses can go on and on, as indicated by the above, to produce such compounds as ethylene glycol ("Prestone" antifreeze); ethylene dibromide and dichloride (by simple reaction with bromine or chlorine); hexachlorethane, by reaction of either acetylene or ethylene with chlorine until six chlorine atoms have been added (or by substitution of chlorine for the six hydrogen atoms of ethane); methanol, by first decomposing methane to carbon monoxide and hydrogen through catalytic action and partial oxidation, then reacting carbon monoxide with hydrogen to produce methanol.

Formaldehyde is an oxidation product of methanol formed by passing the alcohol vapor mixed with air over heated copper gauze. Celanese Corp. makes formaldehyde from butane, recovering such by-products as acetaldehyde, acetone, methanol and organic acids. Butane pre-heated to 572° F is mixed with 110 volumes of steam and 10 volumes of air at about 752° F and 300-400 psi, the reaction being quenched with water after about one second, according to Walker[6]. Presence of a catalyst is not stated.

Formaldehyde and organic acids are removed together by scrubbing the reaction products with water. Pure formaldehyde is obtained by refining this solution. A hundred pounds of butane are reported to yield 15.2 lbs of formaldehyde, 19.6 lbs acetaldehyde, 7 lbs of acetone, 19 lbs of methanol, 1 lb propanol, 0.5 lb of butanol and 11.4 lbs of organic acids. Each of these chemicals in turn is a possible starting point for still more diverse compounds whose number is legion.

In short, as one consulting chemist recently told the writer, "take any of these plants with these simple raw materials, get out your chemistry book, and you will find they can shift from one thing to another without serious complications from equipment design to make most any commercial organic chemical you care to name, from plastics to solvents, from chemical intermediates to 'what have you'."

**References**


(1) Wilde, H. D., "Petroleum as a Source of Chemicals," *Mining & Metallurgy*, July, 1945.

(2) Anon., "Oil Company's Chemicals-From-Natural Gas Refinery Makes Formaldehyde, Methanol and Related Compounds," *NATIONAL PETROLEUM NEWS Technical Section*, 35, No. 3, p. R-72, (Feb. 3, 1943).

(3) Private correspondence with Universal Oil Products Co.

(4) Anon., "Acetylene and Other War Chemicals Made by Cracking in a Regenerative Furnace," *NATIONAL PETROLEUM NEWS Technical Section*, 34, No. 34, p. R-270 (Aug. 26, 1942).

(5) Anon., "Acetylene Production by Electric Arc and Its Purification," *NATIONAL PETROLEUM NEWS Technical Section*, 37, No. 45, p. R-866 (Nov. 7, 1945).

(6) Walker, J. F., "Formaldehyde", p. 16, A.C.S. Monograph Series No. 98, Reinhold Pub. Corp. (New York) 1944.


# Mass Consuming Markets Forecast For New Petrochemical Products

SIGNIFICANT trends which indicate a large peacetime expansion of the chemical manufacturing industry were reported to a recent meeting of the American Institute of Mining and Metallurgical Engineers in Tulsa by Harry P. Hohenadel, general superintendent, Chemicals Division, Cities Service Oil Co. They included:

1—Many of the recently developed chemical products are new creations, not substitutes, and they are as new and original as the invention of the light bulb, and with a field of exploitation almost as wide.

2—Many of these new products will enter the mass consuming markets which require enormous tonnages of products and thus will create an industrial demand for these chemicals on a mass volume basis.

Most of the processes involved in producing these chemicals are adaptable to the use of natural gas, petroleum or refinery gases as raw material, Mr. Hohenadel stated, which is already attracting chemical manufacturers to the southwest. He reviewed the expansion of the chemical industry in the U. S. in the past 25 years and said that the Chemical Bureau of the War Production Board placed the value of chemicals produced in 1944 at $8,300,000,00. The biggest part of this was in war materials.

The mass markets now opening for consumption of chemicals, according to Mr. Hohenadel are plastics; synthetic fibers; building materials such as cement, plywood and transmuted wood timbers; metal-to-metal and metal-to-wood adhesives; soaps and detergents; and the silicones, which range in properties from liquids, plastics and lubricants to insulators and elastomers.

His discussion of these potential and actual markets, summarized, is as follows:

Despite war limitations on use and manufacture of plastics, the dollar value reached $400 million in 1944 and currently tonnage is tending towards one billion pounds a year. Vinylidene chloride polymers derivable from petroleum vary from circular monfilaments 0.007 in. diameter to heavy plastic sections. The field for such polymers ranges from fine fabrics, special ropes,

handbags, shoes and upholstery through such heavy tonnage requirements as window screening and household and industrial plumbing and piping.

The textiles field is using more chemicals than ever before, it was said, not alone in manufacture of synthetic fibers such as "Rayon", but in the treating of woolens and other natural fibers. Rayon, first marketed in 1911, jumped to 4.62 lbs per capita consumption in 1941, for example; cotton reached 26.2 lbs. in 1911, 40.8 in 1941, and wool consumption per capita was 2.64 lbs and 4.48 lbs for the same two years, respectively. Thus, the new and improved products stimulate modifications of the old to meet competition of the new, and, since all are fundamental requirements—clothing—they furnish an inspiration for heavier and more generous consumption by the masses, Mr. Hohenadel stated.

Of outstanding tonnage requirements in supplying shelter, another fundamental requirement of the human race, most important are developments in modern plywoods as a construction item in the homes field, the modified or "transmuted wood" timber in home and general construction and developments in adhesives which ultimately may be reflected in all industrial construction work.

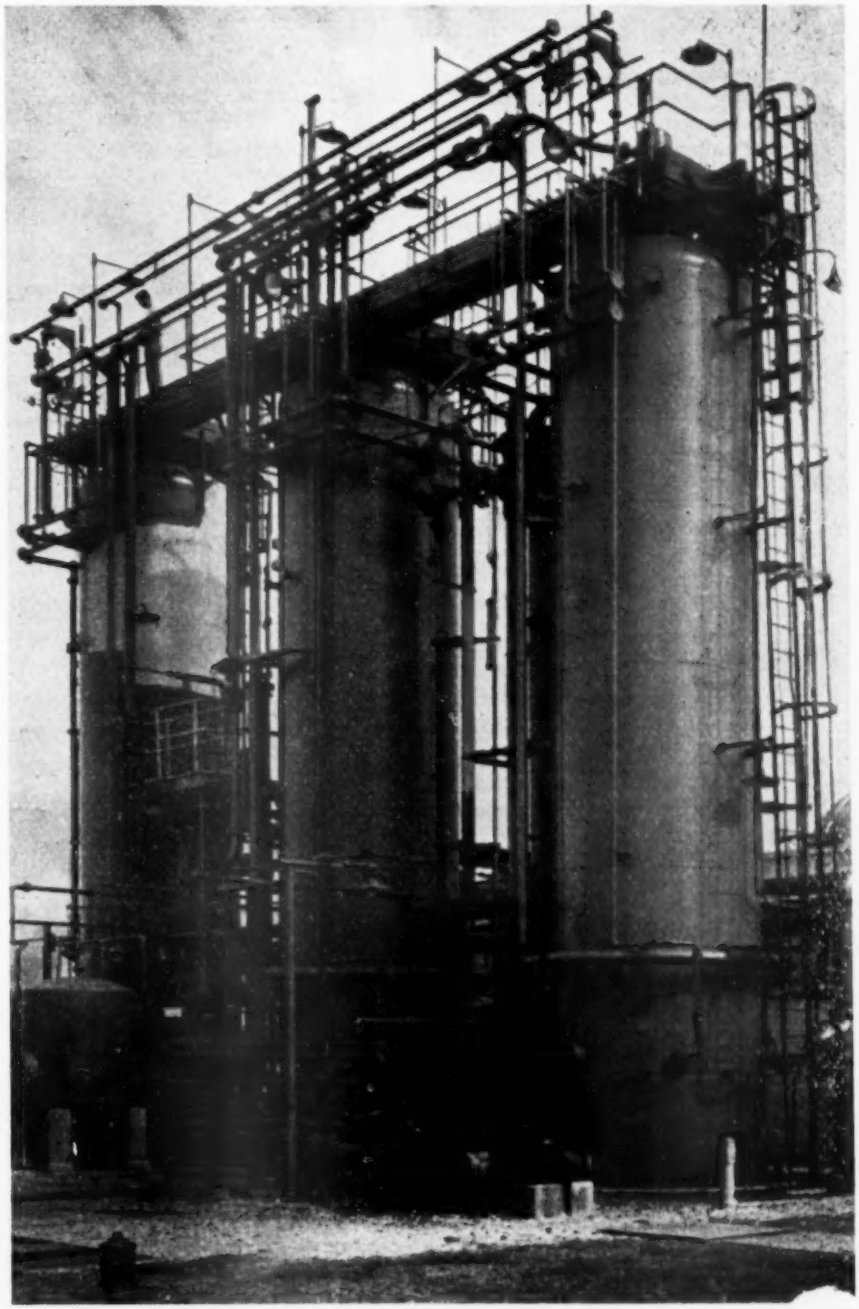
The critical shortages of lumber during the war stimulated search for better bonding agents for plywood, he pointed out. The development of such agents from melamine - formaldehyde and urea-formaldehyde resins permitted evolution of a stout, sturdy, waterproof plywood that obviously is going to the peacetime construction field in mass quantities. The new plywoods are not only stronger and for all practical purposes weather-proof, but can be worked with stainless steel, aluminum and other metals by using the new metal-bonding adhesives to add still more structural strength. Plywood manufacturers estimate new plywoods will develop into a normal market requiring two billion square feet annually.

Wood, such as southern pine, can be made harder, denser, more water-resistant and for all practical purposes rot-, termite- and warp-proof by treatment with such chemicals as urea and dimethylourea—both in part at least derivable from natural gas. Chemical requirements are equivalent to about 15-20% of dry weight of the wood for a thorough hardening job; materially less for "case-hardening." Dyes can be introduced also to impart brilliant colors to the wood. With an unprecedented demand for home and building construction waiting to be filled, and the traditional popularity of lumber as the preferred base material, Mr. Hohenadel believes the above materials will come into wide use.

In the soap and detergent field, the "sulfated" long-chain fatty acids or long chain alcohols form salts with calcium and magnesium in hard waters which are soluble; suds can be developed immediately without formation of curds, waste of detergent, or development of "tattle tale grey" and "ring in the tub." Demand for this type of detergent has increased enormously with the shortage of soap, this authority stated. Several other modifications involving combinations of aromatic groupings such as naphthalene with petroleum hydrocarbons such as propylene offer possibilities for mass volume utilization of these materials.

Demineralization of natural waters to the extent that their purity compares favorably with that attained by distillation is possible by the use of synthetic resins which, in series, remove both anions and cations.. Large manufacturers of treating equipment have developed the process and are marketing units with capacities ranging from a few gallons an hour to millions of gallons daily.

The silicones, Mr. Hohenadel concludes, are so new it is impossible to define their ultimate field. Current interest is centering around the field of high-temperature insulation and heat-resistant lubricating greases. Their use has permitted design of electrical machines of higher temperature limit tolerances, resulting in an increease in power output by as much as one-fourth with 50% reduction in gross weight.



**Ethylene glycol, the principal ingredient of "Prestone" anti-freeze, is one of the main products of Carbide and Carbon Chemical Corp.'s plant at Texas City, Texas**

# Simple Device Saves 51 Hours In Maintenance of Compressors

A METHOD of removing liners from compressor cylinders which eliminates considerable rigger, carpenter and insulator labor, plus necessity for removing the complete cylinder, has been suggested by an employe of Humble Oil & Refining Co.'s Baytown refinery. It is estimated that 8 man-hours of carpenter labor, 35 man-hours of rigger labor and 8 man-hours of insulator labor no longer will be required.

The equipment necessary is shown in Fig. 1, and consists of an A-frame, chain hoist, jack, saddle, and trolley-beam to support the saddle. The jack is placed on the compressor discharge bottle located under the compressor cylinder in a pit, and jacked against the suction bottle located above and supported by the compressor cylinder.

The bottles then are forced approximately two inches apart to clear the bosses on the flanges from the cylinder liner. Cylinder head and compressor piston are removed with the aid of the A-frame and chain hoist.

The small trolley beam then is placed in the cylinder with the three-inch diameter rod on the end of the beam resting in the stuffing box, and the saddle is run down the beam into the cylinder. Jack screws on the saddle are tightened against the liner just enough to support the weight of the liner. Liner then can be pulled out of the cylinder by hand, since it is supported by the saddle; A-frame and hoist are used to handle the liner after it is removed from the cylinder.

Formerly it was necessary to erect rigging to permit the use of chain hoists to hold the suction bottle suspended and to handle additional chain hoists used in removing the complete compression cylinder. A machinist then removed the liner with the aid of additional supports and framework, which had to be erected for the job. In addition, the insulation on the suction bottle usually was damaged and had to be repaired or replaced; all the rigging also had to be torn down when the job was complete.

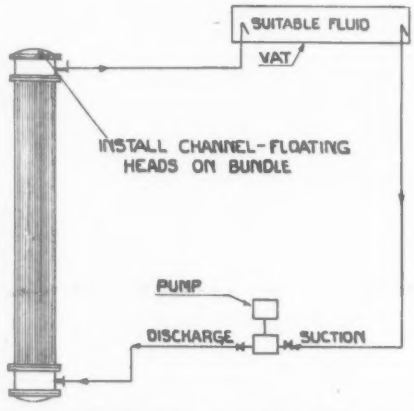



**Fig. 2—Hookup for cleaning exchangers**

AN INGENIOUS and time-saving method of cleaning tube bundles in exchangers on one unit at Humble Oil & Refining Co.'s Baytown synthetic rubber plant now is in general use in the plant. Bundles, plugged with rubber and other substances, formerly were boiled or soaked in cleaning solution before being drilled or punched to clean the tube. Frequently tubes were found to be so badly plugged it was deemed cheaper to replace them.

Present method, as indicated in Fig. 2 is to install channel and floating heads on the bundle, connecting them to a suitable vat filled with hot aromatics or other suitable cleaning fluid. A small pump in the line circulates the solution through the tubes.

Cleaning the bundles the old way required two days on the average, four men putting in 24 hours working time for a total of 96 man-hours. Using the new method, total cleaning time now is 12 hours, requiring the labor of three men for a total of 36 man-hours.

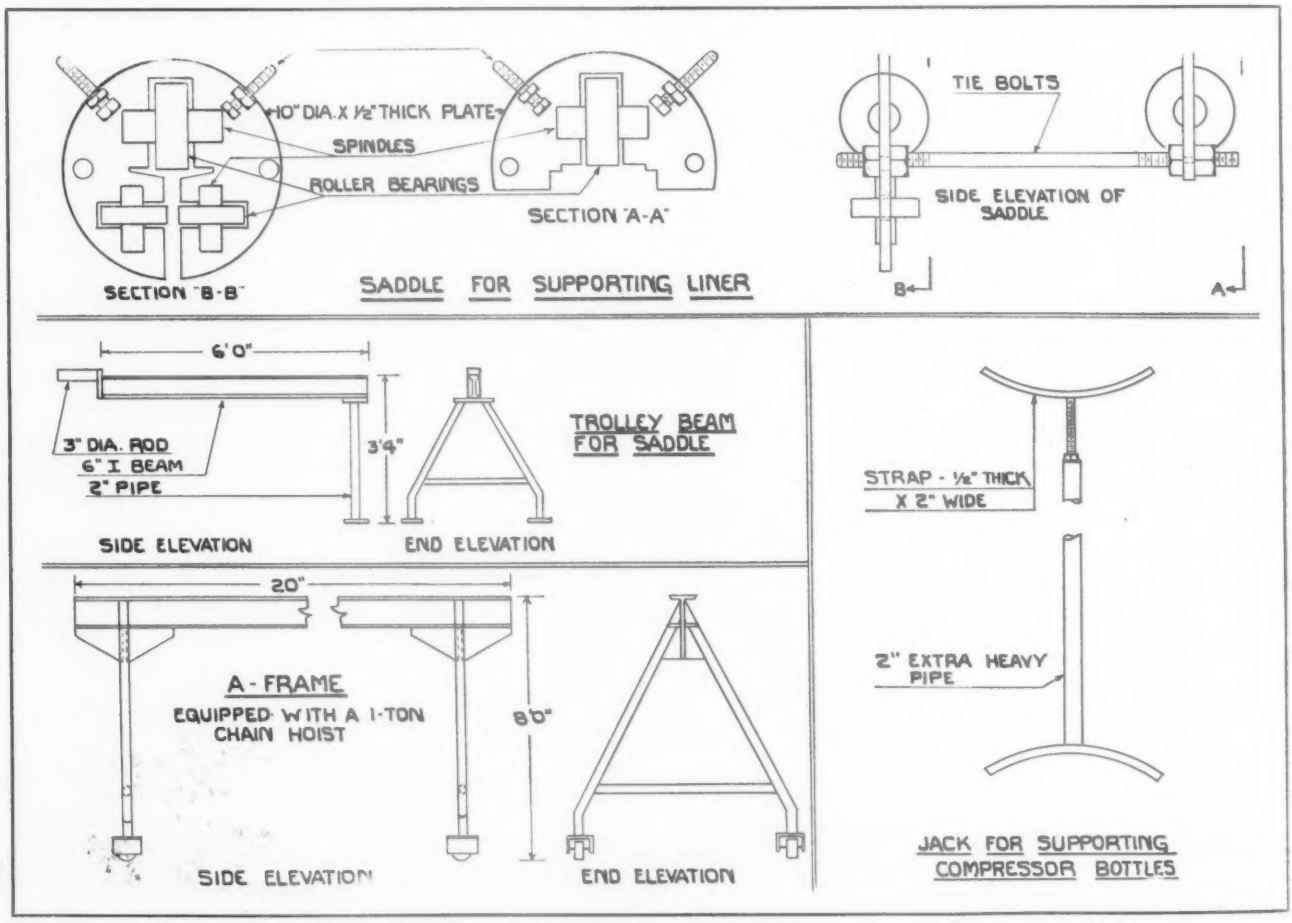



**Fig. 1—Assembly details of equipment for removing liners from compressor cylinders**

Being in most cases a commonplace industrial problem to a given community, the disposal of waste materials in many instances has not been classed as one of the foremost operating matters of the individual petroleum refinery. This attitude has continued over the years despite the increasing attention being given to surface water pollution by recreation leagues, sportsmen's societies and many public agencies.

With the magnitude of industrial expansion during the war, together with the necessity for the new plants, as well as many of the old ones, centering their efforts on volume production in place of less pressing operational functions, stream pollution has increased. Previously clean waters have been affected. Today, therefore, petroleum refineries large and small, and almost regardless of their location, as well as other industrial plants in general, find themselves confronted with new proposals for the disposal of wastes and the prevention of the contamination of surface waters.

For the purpose of reviewing the experience of the petroleum industry collectively with this problem, and to give the practical methods that individual refineries use for the disposal of new types of waste resulting from the new processes, NPN's Technical Section has arranged for an exclusive series of special articles by an outstanding authority in this field. Author of the series is W. B. Hart, Philadelphia, engineer with the Atlantic Refining Co., who for many years has been in charge of waste disposal problems for this company and who has also served in a consulting capacity to many other companies. Mr. Hart is chairman of the Committee for the Disposal of Refinery Waste of the American Petroleum Institute.

# DISPOSAL OF PETROLEUM REFINERY WASTES

## Article 1—Industry's Relation to the Problem

*By W. B. Hart*

*Atlantic Refining Co.*

While a long-standing problem, the general wartime industrial expansion and, specifically, the new processes used in petroleum refineries, have increased the importance of this subject to plant operators. Industrial wastes can no longer be "dumped" into the nearest river or lake. Anti-pollution laws and public opinion today demand disposal methods which do not contaminate waterways. The history of waste disposal and industry's present position in the matter are described in this first of a series of articles on the subject.

### *Introduction*

The disposal of petroleum refinery wastes is a many-sided problem of relationships and methods. Any discourse on the present-day, overall aspect of this problem should include discussions of these various relationships, of procedures for attack on localized problems, and of processes for treating wastes to assure that they will be in satisfactory condition for proper disposal.

The petroleum refining industry is directly concerned in the disposal of its wastes, and by its attitude towards the problem it establishes its position in the eyes of the public. Its activities are directly related to those of the various authorities who enforce the laws and regulations under which, insofar as waste disposal is concerned, the industry must operate. Finally, there is the relationship of the industry, through its methods for disposing of its wastes, to the general program for the conservation of natural resources.

It is proposed to discuss these relationships in the light of several years' experience with waste disposal problems of the petroleum refining industry and several other industries. The effects of various types of refinery wastes when these wastes are discharged without treatment into the surface waters of the country or into the sea will be discussed. Organization within a company and within the industry for the control of waste treatment and disposal will be taken up, as well as methods for preliminary investigation and attack on localized problems. Waste treatment processes which have provided effluents acceptable for proper waste disposal will be described in some detail and, in more general terms, processes which apparently are the most promising for the treatment of wastes from the more recently developed petroleum refining operations. A summary and bibliography will conclude the presentation.

Obviously, such a broad subject cannot be covered in a few brief paragraphs. It is planned, therefore, to present the discussions in a series of articles which it is hoped will be interesting, informative, constructive, and useful to the petroleum refining industry—and perhaps to others.

• • •

WHEN something is of no further use to us the natural and usual procedure is to discard it—throw it away. That is good, orderly housekeeping and should not be criticized. But if that something is carelessly thrown away, without regard for or consideration of the nuisance and expense it may cause others, then criticism is deserved.

It is the manner in which the petroleum industry discards its wastes (i.e., whether they are treated if necessary) that relates the industry to either proper waste disposal or to water pollution, and that establishes the position of the industry in the eyes of the general public.

It lies with any element of the industry willingly to make the choice between proper waste disposal or water pollution. If, through its action, there is factual evidence that a refinery has decided to permit pollution to continue to exist there is the ever increasing probability that it will be compelled to discontinue

such practices. In general, that is the position of many industrial establishments today. In tracing the development of this position, the story of the refining industry, with some exceptions, is so similar to the story of all industry that the story of industry in general will be the most enlightening.

The public generally has come to think of waste disposal and water pollution in terms of "sewage," meaning the sanitary wastes of communities of people, and of "industrial wastes," meaning the many and varied wastes of industry. It would be difficult to establish accurately whether over the entire country, "sewage" or "industrial wastes" have caused more serious damage to our surface waters (i.e., rivers, streams, lakes, etc.). Often these waters have received large flows of both sewage *and* industrial wastes concurrently.

A general comparison of the effects of sewage and industrial wastes when discharged into surface waters is important in tracing the position of industry.

### Effects of Sewage and Wastes

Sewage is largely organic in nature. In the presence of oxygen dissolved in the surface waters it is converted by organisms which live in the waters into harmless substances, such as water and carbon dioxide. The products of the conversion are useful, in general, to other forms of aquatic life.

Sewage is not lethal to aquatic life in the sense of being toxic. It drives away or destroys such life forms only when the sewage is present in excessive amounts and requires more dissolved oxygen for its conversion to harmless substances than is available. When this occurs there is said to exist an "oxygen deficiency" and no dissolved oxygen, which is essential to practically all forms of aquatic life, remains. Consequently, these forms either must leave or be asphyxiated. Many of these forms are essential to the biological process commonly known as "stream self-purification," by which the surface waters normally can maintain their cleanliness and their natural usefulness for various purposes.

Some industrial wastes are similar in nature to sewage. On the other hand, many are decidedly toxic, and are rapidly lethal to practically all forms of aquatic life, including those essential to "stream self-purification," even in the presence of ample dissolved oxygen. There have been many instances of this lethal action, and it can be demonstrated readily in the laboratory.

Sewage causes only what might be regarded as temporary pollution, from which a stream, for example, through self-purification can recover its normal cleanliness in a relatively few miles of flow, provided no more sewage is discharged into it.

In comparison, many industrial wastes impair the quality of surface waters (into which they are discharged) to a considerable degree of permanency. They make the waters unfit or unsafe for a variety of applications, or at least make it costly to purify the waters sufficiently so that they will be generally useful.

Finally, surface waters can be polluted heavily with sewage and the condition will not be detected readily by the untrained eye. Many industrial wastes, however, are almost spectacularly apparent after discharge (e.g., oil, "white water," colored wastes from cleaning and dyeing establishments, silt and culm from various mines, blood and entrails from abattoirs, etc.).

This contrast, perhaps above all others has engendered the idea that industrial waste pollution not only is the more prevalent form of pollution but also the more serious, and has gained for industrial wastes the reputation of being the major factor in pollution. It early placed industry, including petroleum refining, in a bad light.

Without going into any considerable detail it will be profitable to review just what industry has done and is doing about its position in relation to disposal of its wastes, for lessons which will be of value in the future can be learned.

When industry was in what might be termed its infancy, industrial establishments were relatively small and scattered, processes were rather simple, and wastes were not great in quantity nor complex in quality.

The most convenient way to get rid of the wastes was to discharge them into the nearest surface water that would carry them away. When they were discharged into the surface water either they were so rapidly diluted that they quickly became inocuous, or were converted to simple, harmless compounds. Consequently the quality of the receiving surface water was not seriously impaired; there had been no infraction of laws or regulations for there had been no abuse of the surface waters and there *were* no laws or regulations; no one was damaged; and, in general, few people (if any) gave the matter much thought.

Similarly, existing small towns and cities discharged their sewage into the nearest surface water. It too was carried away and converted into harmless substances without impairing water quality seriously and without attracting any particular attention.

### Surface Waters Were Adequate

The surface waters thus served one of their proper purposes, the drainage of their various basins or water-sheds in an efficient, natural, and orderly manner. This could occur only because the processes which make such natural and orderly drainage possible were not unbalanced or eliminated.

Industrial activities increased greatly and concentrated in communities, the population of these communities also grew extensively and rapidly. Usually, each community was located on some river or lake, and the wastes of the community, both sewage and industrial wastes, con-

### Waste Disposal Authority Authors Series

For over 20 years, W. B. Hart, author of this series of articles appearing exclusively in the NPN Technical Section, has been actively connected with the problems of petroleum refinery wastes—their effect on human and animal life, and how to properly dispose of them.

Mr. Hart is recognized as an outstanding authority in the field, and at present is in charge of industrial waste disposal for the Atlantic Refining Co., Philadelphia, with which firm he has been associated since 1923. His services are frequently "borrowed" from Atlantic by other firms to help them solve particularly difficult waste disposal problems of their own.

He played an important part in the preparation of early American Petroleum Institute manuals on the subject, and at present is chairman of the API's Committee on Disposal of Refinery Wastes. He is also co-author of a recently issued booklet on "The Evaluation of the Toxicity of Industrial Wastes, Chemicals and Other Substances to Fresh-Water Fish."

A graduate of what is now the University of Pennsylvania, Mr. Hart holds the degree of Doctor of Pharmacy.

W. B. Hart

tinued to be discharged into the waters. But now the wastes of industry were greatly increased in quantity and generally more complex in composition; the quantity of sewage discharged also was much greater. These larger amounts of sewage and more complex industrial wastes were more than the surface waters could either dilute to a condition of being innocuous, or convert to harmless substances.

In some instances the industrial wastes contributed more to the overload than the sewage, and in others the sewage was the principal offender. In any event, pollution had been introduced and many uses of the waters were either seriously impaired or became uneconomical. Health hazards which previously had been relatively negligible became serious and rather common.

But the habit of throwing useless things away in the easiest manner also had become established, although now it no longer could be said that no one thought or did anything about it. The voices of various groups were raised in an ever increasing clamor, and there was the usual result of abuse—legislation was proposed.

### Industry Failed to Look Ahead

In the period from about the turn of the century to about 1920 many industrial establishments and municipalities failed to look far enough ahead. They failed to understand the significance of what was taking place or else they simply ignored it. There should have been realization that industrial wastes would increase in quantity and probably become more complex in composition, and that sewage from an increasing population would become greater in volume. It should have been appreciated that our surface waters, on the other hand, are relatively constant in their average flows and in their ability to drain a region without serious impairment of the water quality.

The result of the conflict of these conditions (i.e., increase in waste load and uniform average surface water flow) should have been obvious. It should have been apparent that many of the surface waters of the country soon would be so overloaded that they could no longer repurify themselves and as a result their normal usefulness would be either greatly degraded or destroyed; that many would become septic and that there would be serious health hazards; that water purification plants would be taxed dangerously near to the limit of their ability to produce safe supplies; that even simple uses of water (e.g., for cooling) in many instances would become expensive due to costs not normal to such processes; and that aquatic life of practically all kinds, important to health, recreation, and commerce, would be destroyed. All these effects of pollution have occurred in not a few but in many places over the country, particularly where industrial establishments and population are concentrated.

The reaction of the various elements of industry differed at what might be termed this cross-road period. Some ignored the whole matter; others apparently gave it some thought, for there are waste treatment plants in operation today which were built during the period. The net result of the reactions, however, was practically negligible accomplishment in waste treatment for protection of surface waters and removal of the overload imposed on the waters.

Nor was there any significant effort on the part of many municipalities to treat their sewage, although some treatment plants were placed in operation. Pollution, therefore, continued to develop, and spread rapidly as industry and population spread. In general, pollution was gaining rapidly in the race with its control.

The refining division of the petroleum industry was party to this whole situation, although criticism more frequently was directed at other divisions of the industry. In fact, the first federal "pollution" legislation was aimed particularly at oil pollution of coastal and other navigable waters by various oil burning and oil carrying vessels. But refineries cannot be held entirely blameless, for they also contributed to the pollution by oil of inland waters. The petroleum industry by this time had gained the reputation, in some circles, of being one of the "four horsemen of pollution."

A subsequent period, in which there was much activity in connection with pollution and its prevention, extended from 1921 to 1942. During this period there was evidenced a tendency on the part of some elements of industry to abandon the policy of ignoring the water pollution problem and instead to look around for some way of doing something about it.

### Anti-Pollution Groups Gain Strength

Other elements, however, continued as in the past. Some openly opposed all legislation introduced and ridiculed the efforts of the so-called "proponents of clean streams." But the groups advocating pollution prevention, and supporting legislation for this purpose, were growing in numbers rapidly, and also in influence. Collectively they were becoming powerful.

Although several states earlier had passed laws for the protection principally of public water supplies and public health, the first real anti-pollution law was the Federal Oil Pollution Act of 1924[1]. This had the effect of centering the attention of the entire petroleum industry on the importance of preventing pollution by oil.

The American Petroleum Institute had been in existence for about five years by that time and had organized a committee on oil pollution prevention. This committee lacked technical background and was made up largely of executives. It had accomplished little in a constructive way toward pollution prevention, but in 1926 it sponsored an inspection of oil industry establishments over the entire country.

This inspection, which it should be remembered was concerned only with pollution by oil, was carried out in 1927, and to the credit of the oil industry it should be said that it did not turn out to be a so-called "whitewash" as many suspected. Instead, the report[2] of the inspection in general stated that oil pollution did exist. It was recommended that a committee of technical men be appointed to devise methods for its prevention. This committee was appointed in 1928 and organized for action the following year.

In 1930, when the A. P. I. was reorganized into three divisions, one each for Production, Refining and Marketing, a technical committee for the disposal of wastes was established in each division. For the Refining Division the Committee for the Disposal of Refinery Wastes functioned first in 1930. This marked the beginning of a really constructive attack on the water pollution problem.

### State Legislation Increases

Meanwhile, the "hue and cry" against water pollution was increasing and, by 1931, proposed legislation began to pour into the hoppers of many state legislative bodies. But much of industry maintained the position of years past and sent their representatives to oppose this bill and that.

Some of this opposition when reviewed is almost amusing. For example, when in the early thirties an anti-pollution bill was introduced in the legislature of one state it was opposed on the ground that pollution prevention was definitely a federal and not a state matter. But only a few years later the same groups opposed federal legislation on the ground that federal control would be an invasion of state rights. At about the same time, in a meeting of industrial representatives, a statement was made that in a few years there would be no pollution problem.

Other arguments and reasons were advanced by industry, but always in opposition to whatever legislation was proposed unless it was regarded as harmless, and thus all industry, in the public mind, was considered to be objector and obstructionist. In effect, water pollution became the subject of what could be regarded only as a controversy, with the general public, various sportsmen's clubs and commercial fisheries, nature, health and similar associations on one side, and a large part of industry on the other.

The position of industry was set out in bolder relief between 1932 and 1942, for during this decade many sewage treatment plants were installed[3] and much pollution of surface waters by sewage was eliminated. As a result, pollution by industrial wastes was left standing out like the proverbial sore thumb.

In the 20 years under consideration the

results that industry should have anticipated years before, and made efforts to correct, became reality. Industry did develop and expand tremendously, and its wastes increased in quantity and complexity. Pollution increased and spread, although sewage pollution was reduced to a considerable degree. Abuse of surface waters continued, however, and more laws were proposed to combat it.

Of great significance was the fact that the proponents of clean streams, often using in a clever manner the very arguments which in the past had been used against them, began to win their various state battles, and laws were enacted in several states. Some were quite drastic.

But much of industry, including many refineries, did little or nothing about waste treatment. Some did not even organize to study their problems to learn what degree of treatment their wastes required, or how treatment could be accomplished. The position of industry generally, with the exception of some improvement here and there, was about the same. And then came the war.

### War Delayed Program

It was obvious that our surface waters and their uses would not be worth saving if we could not save ourselves. Consequently, all industrial effort was directed toward production of vital materials and equipment. Some effort was made to hold the ground which had been gained previously and to prevent gross pollution, but with the magnitude of the industrial expansion, pollution was bound to increase and often it affected previously clean waters.

More state legislative bodies, recognizing this condition and also recognizing the value of surface water improvement in the program to provide jobs after the war, passed laws aimed directly at the prevention of water pollution and providing for the clean-up of surface waters generally. Now that the war is over, the post-war period for which almost innumerable water protection plans have been prepared is at hand.

In what position does industry, including the petroleum refining industry, find itself today in regard to the problem? In the first place it is surrounded by many new and pretty drastic state laws, and the temper of authorities is to enforce them. Secondly, industrial establishments have expanded so greatly in size that the plants necessary for the treament of their wastes will be major installations in magnitude, complexity, and particularly in cost. Thirdly, many establishments do not know just what treatment their wastes require and consequently have no treatment processes devised. Faced with this situation, many companies are being required under various forms of authority or legal pressure to install waste treatment plants to stop pollution. Others will be required to install plants in the not too distant future.

How industry came to be in this position brings out the lessons which have been referred to previously. These lessons have bearing on the future, for industry still is faced with the choice of either willingly giving greater attention to waste disposal, or of continuing opposition to compulsory waste treatment. How successful such opposition may be can be judged best from experience. Just what this experience has been is worth some consideration.

Probably the basic reason for industry's present position is lack of foresight. There should have been realization that sooner or later the increase in industrial waste and sewage would overwhelmingly overload the surface waters, and waste treatment methods and equipment should have been installed. The installations then could have been paid for out of earnings, as it were, and the additional wastes of today would require only modification or addition. Now, however, costly, complete plants will be necessary, and not infrequently they will have to be paid for over a very short space of time.

Secondly, there should have been endeavor to learn what degree of treatment was necessary. Instead, the frequent reaction was evidenced by the question, "Why should we have to make our waste waters fit to drink?" There is no instance of common record where any industrial establishment has been required to treat its wastes so that they would be potable, or has done so voluntarily. But now, when some establishments suddenly are required to install treatment plants, there often is lack of knowledge not only of what degree of treatment is necessary but also of what waste or waste component it is that causes the pollution. Consequently, often there is a scramble to get some sort of plans on paper, or a plant in operation, or to meet some similar situation with which the operators are confronted. This state of affairs is not conducive to an efficient process or plant, and costly modifications or reconstruction may be necessary later. These conditions usually are avoidable when the establishment makes an early start and does not have to work under pressure, so that there is time to develop the best process and design the most economical plant.

### Past Efforts Gave Bad Impression

Thirdly, many industries spent much thought, time, and money in a manner which only created the impression that they were trying to avoid doing anything at all about water pollution, even though with every public discussion or public hearing it became more and more evident that such procedures could not prevail and only engendered more pronounced adverse public opinion. This money could have been spent more profitably devising means for waste treatment. Petroleum refining was not in complete unity about these activities but the entire industry was accorded the adverse consideration. And to what avail? While federal legislation in recent years has been avoided, probably only temporarily, equally forceful and comprehensive legislation has been enacted in several states (e.g., 4, 5, 6, 7) and is pending in several others.

Fourthly, great advance in the disposal of municipal sewage has been made, and a great many sewage treatment plants have been installed during the past 15 years, and many more are planned. These plants are being paid for by money which in some form of taxation has been collected from the public. The plants have for their purpose the clean-up of surface waters, and this effort has gained great public appeal. It is hard to believe that the public will stand by idly and see its efforts defeated by pollution caused by industrlal wastes. The elimination of sewage pollution or at least the major part of it, will be brought about, for too much is becoming known as to the health hazards that it creates, and the epidemics of water-borne disease to which it can contribute, to think even that it can continue.

### Pollution Sources Will Be Highlighted

Finally, the plans for the post-war period already referred to(8) contemplate extensive activity in connection with surface waters. They involve, among other objectives, the development of health and recreational values, water supply, water power, irrigation and navigation. The major number of these plans have to do with inland waters, and many with waters along which some of our largest refineries are located. If even half of them are carried out they will bring to any region such attention that any considerable pollution by industrial wastes will be completely advertised, and traceable, and under great pressure for abatement. All these and other conditions confront those many industrial establishments which have not provided already the necessary treatment for the proper disposal of their wastes.

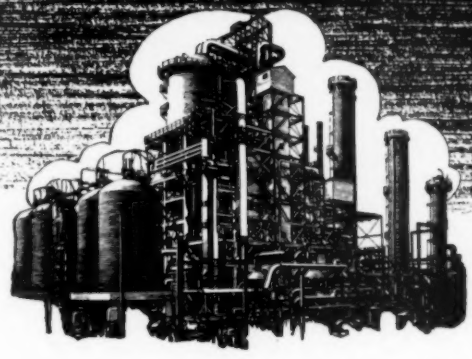
There still may be the disposition on the part of some establishments to do nothing about the pollution they are causing by not treating their wastes. The lessons of the past indicate that this probably will result in stricter administration of existing laws and the enactment of even more drastic ones. If there is the disposition to oppose their passage it is difficult to imagine what arguments can be advanced which will be sound and logical. Those used in the past generally have been turned against the industries who have presented them.

The argument of states rights versus federal control has been offset in large degree by the policy of state compacts in which several states join together to control an entire water-shed(e.g., 9). This probably is the most logical way of protecting interstate streams. Drainage basin authorites and interstate commissions also have been established in some regions for specific sections of a drainage

# BREAK THE BOTTLENECK WITH...

## AEROCAT*

SYNTHETIC FLUID CRACKING CATALYST



COKE FORMATION . . . bottleneck in automotive and aviation fuel production... is a basic reason for specifying *the* "cat" that can do so much to overcome this refining "headache." For with AEROCAT synthetic fluid cracking catalyst, ease of carbon burning plus increased burning rate eliminate costly, clogging accumulation of coke residue . . . and efficiently achieve a throughput to conform to the capacity of your catalytic cracking units. And note these other AEROCAT performance efficiency and economy advantages...

With AEROCAT, it is not necessary to alter plant conditions to compensate for variations in catalyst quality. *AEROCAT is uniform* in quality, high in activity and rugged in structure. And due to particle size, stack losses are reduced to a minimum.

Quantity supplies of AEROCAT are available for immediate delivery from Cyanamid's plant at Fort Worth, Texas. Our technical field service representatives are ready to offer you practical assistance to achieve maximum AEROCAT performance results.

*When Performance Counts... Call on Cyanamid*

**Trade-mark of American Cyanamid and Chemical Corporation denoting cracking catalyst of its manufacture.*

**AEROCAT assures:**

1. Low carbon formation
2. Ease of carbon burning
3. Increased burning rate
4. Minimum of coke residue
5. Minimum stack loss

...all of which adds up to MORE PRODUCTION—MORE EFFICIENTLY!

U. O. P. SYNTHETIC
*Fluid*
CRACKING CATALYST

American Cyanamid & Chemical Corporation

(A Unit of American Cyanamid Company)

30 ROCKEFELLER PLAZA • NEW YORK 20, N. Y.

basin or for specific bodies of water [9, 10].

These state compacts, drainage basin authorities, and so forth, by instituting generally uniform regulations, in large degree will answer the argument that state laws may be more drastically administered in one state than in another, and that therefore an establishment in one state may enjoy a better position in competition than another just over the state line where administration is more lenient.

As is true of most things, waste treatment plants cost money, and another argument that has been advanced is that some establishment simply could not afford to build treatment plants because of financial condition or very narrow margin of profit. The matter of financial condition often has been questioned, and may or may not be true. The matter of margin of profit has elicited a counter question which asks whether a narrow margin of profit is a valid excuse for not treating wastes if it is gained through the inconvenience, damage, and expense which the untreated wastes cause for others.

### More Study Needed

It often has been stated that water pollution problems require more and more study and investigation, and this feature has been included in much proposed legislation, particularly federal legislation. There is little if anything in this world which would not profit from more study. But in opposition to this the argument has been advanced that little would be accomplished unless the results of study were applied. In the literature there are almost countless references to waste treatment methods and if half of these had been adopted, possibly industry would be in a much better position than it is today.

Study should be continued, of course, to develop more economical methods. The use of unit processes in the manner that chemical engineers have developed for all industry, and which is familiar to the refining industry, should be developed fully, so that an appropriate process, modified as necessary, can be incorporated into the solution of a specific problem. These processes are both chemical and biological, and there are many well developed and available today.

The above discussion may appear to be a drastic indictment of industry, and, by inference, of the petroleum refining industry. That is far from the intent. What has been said in considerable detail is intended to point out to industry, and particularly the refining industry, the futility of adhering further to the policy of objection and obstruction. Much could be said to support the soundness of the recommendation that such a policy be abandoned, but more impressive will be the many examples in all sections of the country where even during the war years waste treatment plants have been installed.

Since the end of the war planning and even construction have been started on many more. Some of these will be installed willingly, some because it is considered that it is best to do, and some under compulsion. But they all will be a credit to industry.

This is evidence that there is realization by industry of its position in relation to disposal of its wastes. And there is more evidence of this in the decided improvement in the condition of our surface waters in many localities. The lessons mentioned above are bringing about results.

Industry, except in a few instances, does not deserve drastic indictment in connection with waste disposal. Probably the most serious charge that can be levelled against it is that industry lacked foresight. Its other actions all can be traced to this.

Yet industry in some instances must have been looking ahead. Several years ago the textile industry established the Textile Foundation, which, along with other activities, is engaged in developing methods for treating textile industry wastes. The foundation has done some excellent work. The Iron and Steel Institute began work on the wastes of that industry some years ago and has made creditable contributions. More recently the pulp and paper industry established a foundation for research and development in the treatment of its wastes. It is well staffed and undoubtedly will make important contributions to the solution of waste treatment problems of pulp and paper manufacture. Other industries have organized or are preparing to organize similar research and development groups.

### A.P.I. Has Worked on Problem

The A. P. I. Committee for the Disposal of Refinery Wastes has been active since 1930 and has published methods by which refinery wastes can be treated so that they will not adversely affect the surface waters into which they are discharged [11, 12, 13]. Realizing the emphasis which has been placed on water pollution prevention, the committee has intensified its activities during the past two years and is sponsoring research projects in some of the country's universities.

All these activities of the various elements of industry point to the fact that industry in general is now in a much better position, but best of all is on the road to a position where the pollution controversy may cease to exist.

Although a general survey of industry's position shows a great deal of improvement, and that much of this improvement has come about in the petroleum refining industry, there still are some refineries which have not changed from the old attitude. Also, plans and blueprints will not treat wastes or prevent pollution. They first must be translated into equipment in successful operation. Unless this is done willingly, and in reasonable time, it is very probable that other federal or state authorities will resort to compulsion. These authorities have the power to enforce such action, and have exercised their powers in the past. There is nothing to indicate that they won't do likewise in the future.

### Next Month

**"The Industry and the Authorities" will be the subject of the second in this series of articles on the disposal of refinery wastes, being written by Mr. Hart exclusively for the NPN Technical Section. In it he will discuss the various laws pertaining to waste disposal and the authorities whose function it is to enforce those laws to the end of protecting our surface waters against pollution.**

#### References


(1) Federal Oil Pollution Act of 1924. June 7, 1924. (S.1942) (Public, No. 238; Sections 3, 4, 5, and 7).

(2) Report to the Directors of the American Petroleum Institute on the Oil Pollution Survey of 1927. Files of the American Petroleum Institute, New York.

(3) *Sewage Works Engineering;* a list is presented in each issue from Vol. 13, No. 2, 74-86, Feb., 1942, to Vol. 15, No. 4, 191-192, April, 1944; also Vol. 15, No. 11, 565, Nov., 1944.

(4) The (Pennsylvania) Pollution Act of 1937, June 22, 1937 (P.L. 1987), amended by the Act of May 8, 1945 (No. 177).

(5) The Indiana Water Pollution Act of 1943.

(6) The Texas Water Pollution Act of May 24, 1945. (H.B. 439).

(7) Act No. 146 of the Acts of the 1943 General Assembly of Arkansas (Section 17—Industrial Stream Pollution).

(8) *Sewage Works Engineering,* Vol. 13, No. 1, Jan., 1942, to Vol. 16, No. 5, Sept., 1944. *Sewage Works Journal,* 16 (2): 222-277, March, 1944; 16 (4): 759-773, July, 1944; 16 (5): 936-965, Sept., 1944. *Sewage Works Engineering,* 16 (10): 534, Oct., 1945.

(9) The Ohio River Compact. Federal approval by Federal Act (Public-739); 76th Congress—Chapter 581—3rd Session; (S. 3617). Pennsylvania ratification —Pennsylvania Legislature, Act No. 50, April 2, 1945. *Sewage Works Engineering,* 16 (10): 490, Oct., 1945.

(10) Tri-State Treaty Commission (New York-New Jersey-Connecticut). Laws of the State of New York of 1931—Chapter 671. Joint Resolution No. 8 of the Senate and General Assembly of the State of New Jersey adopted April 21, 1931. Chapter 142, Section 423-A of the laws of the State of Connecticut of 1931. (These laws established the Commission).

(11) *Manual of the Disposal of Refinery Wastes, Section I—Waste Waters Containing Oil.* The American Petroleum Institute, New York, 1941.

(12) *Manual of the Disposal of Refinery Wastes, Section II—Waste Gases and Vapors.* The American Petroleum Institute, New York, 1931.

(13) *Manual of the Disposal of Refinery Wastes, Section III—Waste Waters Containing Solutes.* The American Petroleum Institute, New York, 1935.

# Study of Corrosion Pattern in Still Tubes Results in Reduction of Metal Losses

**How one oil company saves materially on still tube replacements through relating the rate of internal corrosion to the position of the tubes in the furnace is told in an exclusive article for the NPN Technical Section. The annual measurements of the inside diameters of the successive tubes from furnace inlet to outlet were plotted, with other pertinent data. This pattern for corrosion provided the basis for more efficient selection of metal for replacement tubes, which has added substantially to tube life.**

*By*

*William F. Kramer*

*Chief Inspector*
*Toledo Refinery*
*Pure Oil Co.*

THOUSANDS of dollars are expended each year to replace metal lost by various forms of corrosion. No small percentage goes into the petroleum refiners' direct-fired oil heaters.

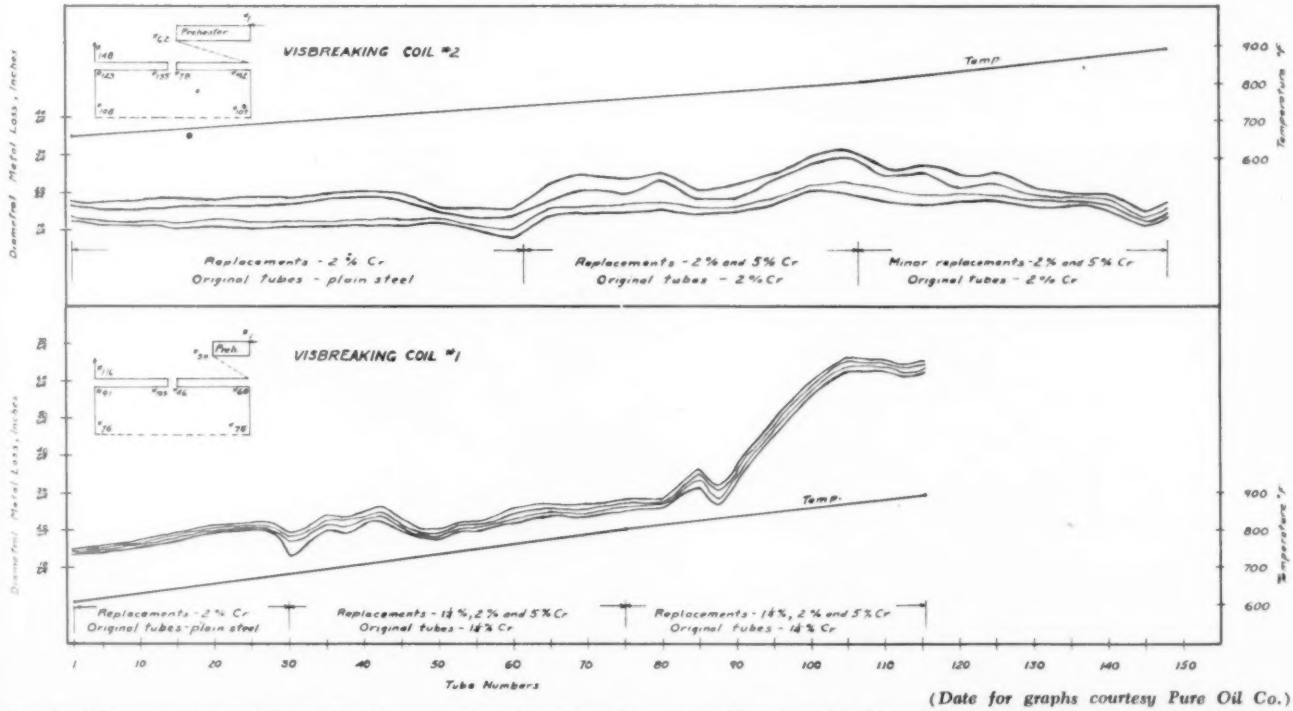
Deterioration of the tubes in these stills or furnaces may cause failure within a few hours or after many years, depending upon operating conditions and the type of alloy employed. Selection of the proper alloy, based upon the frequency of failure and consequent replacement, is of primary importance. The deterioration occurs often at the inside and outside surfaces of tubes simultaneously. However, it is usually the internal corrosion which particularly concerns those responsible for replacement prior to disastrous failure.

It is not the purpose here to go into the reasons for this corrosion but rather to describe experiences with metal loss in the furnace tubes at one refinery. Because corrosion in crude oil heaters is mild, only cracking still tubes are considered.

Inspection records were reviewed in an endeavor to determine the effect of certain variables on the rate of penetration. In the course of this review, it became apparent that charts drawn to show the location of the most severe attack made distinctive patterns. The place for more frequent replacement or for better alloy was also thereby located. As the biologist reads the rings of growth on the tree stump, so we may trace the path of corrosion through the furnaces, with the added advantage that some prediction of the expected future life of the tubes is possible.

The location of a tube in a furnace has a direct bearing on the amount of metal loss experienced in it because of such variables as temperature, turbulence, and coke deposition. Quantity of corrosive material in the flowing oil should not be overlooked. It varies with the amount of chemical reaction along the path of flow. The charge oils during the period covered here were relatively uniform, as were other conditions of operation. They were produced by primary distillation of Illinois, Mid-Continent, and small amounts of Michigan crude oils.

Equipment is inspected at suitable intervals to insure safety and continuity of operation. Inside diameters are measured at each tube end where expanded to make the joint with the return bend. The maximum inside diameter is also determined in the portion of the tube within the combustion chamber of the furnace. Measurement of inside diameters is an indirect but convenient method of estimating wall thickness when the outside diameter is known. Thus, over a period of time the records of these measurements will show increases where corrosion has been at work. With these indications appropriate action may be taken. Due allowance must be made for mechanical damage from mishandled cleaning equipment and for local overheating when




*(Date for graphs courtesy Pure Oil Co.)*

**Fig. 1—Diagram of metal losses in furnace tubes in visbreaking coils Nos. 1 and 2, based on four years' measurements of inside diameters. In upper lefthand corner is furnace tube flow diagram to assist in locating arrangement of tubes.**

unexpectedly heavy coke deposits are formed.

It is axiomatic that a chain is as strong as its weakest link. Similarly, a tube must be retired because of its weakest or poorest point. Omitting cases of severe external oxidation or overheating, most tubes are retired when the walls become thin at the ends. It is generally accepted that turbulence caused by reversing the flow of the oil at each return bend is the guilty factor. Increased metal loss occurs particularly at the inlet ends.

With the knowledge that the tubes would be retired when the walls at the ends closely approached or reached a minimum safe thickness, master charts were constructed, using the largest inside diameter for each. They indicate the corrosion trend and probable replacements throughout the various cracking coils. The four most recent measurements made at yearly intervals were plotted for each successive tube from furnace inlet to outlet. In order that cumulative experience might be revealed, gains in inside diameters for previous tubes, if any were retired, were added to the earliest readings for these diagrams. Considerable irregularity in the pattern thereby results when less resistant tubes were in service or more severe conditions existed formerly. Yet, present tubes have small yearly losses and give uniform, closely spaced points on the graph. For ease of comparison, the vertical scale was converted to "diametral metal loss" in 64ths of an inch, which is equivalent to increase in diameter or twice the penetration rate. The yearly penetration rate (ipy,) may be determined from the vertical distance between any two adjacent points for individual tubes, since these were established by calipering annually.

TABLE 1—Penetration Rates for Original Tubes of Visbreaking Coils

| Sections | Coil No. 1 Tubes | Coil No. 1 IPY* | Coil No. 2 Tubes | Coil No. 2 IPY* |
|---|---|---|---|---|
| Preheater | 1-30, plain steel | 1/64-3/64 | 1-62, plain steel | 3/64-6/64 |
| Heater | 31-75, 1¼% Cr. | 1/64-2/64 | 63-107, 2% Cr. | 1/64-2/64 |
| Soaker | 76-116, 1¼% Cr. | 12/64-45/64 | 108-148, 2% Cr. | 1/64-2/64 |

*Inches penetration per year.

Three sets of typical diagrams are presented in Figs. 1, 2 and 3. They are arranged in pairs to permit comparison of similar coils which comprise two combination distillation and cracking units. There are only slight differences in the design and operating conditions. In these selective cracking systems, topped crude, heavy gas oil, and light gas oil, combined with various amounts of recycle oil, are charged to the several furnaces individually to permit processing each under appropriate conditions.

The temperatures of the flowing oil are also indicated on the diagrams, assuming straight line conditions between the three points shown as recorded on the instruments at the units. Included are furnace tube flow diagrams to assist in locating the various points as they exist in the tube arrangement.

As evidenced in Fig. 1, the charge oils

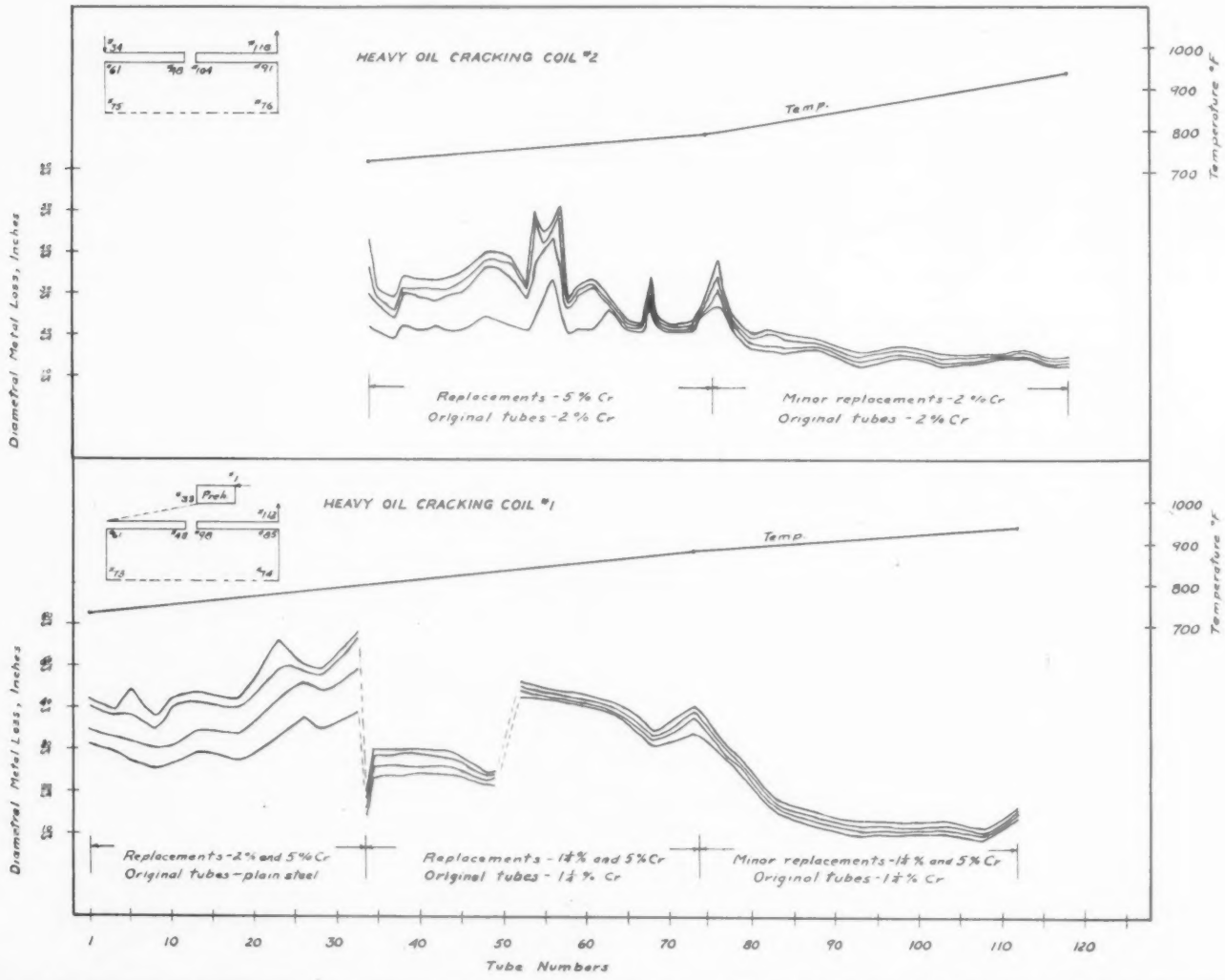
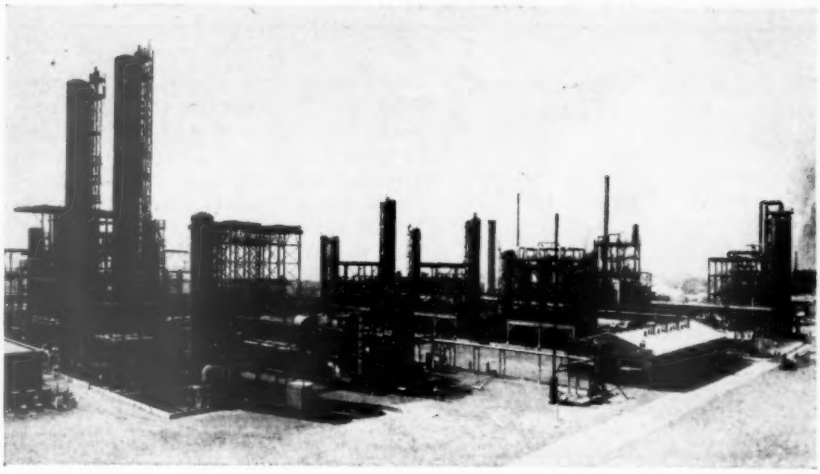
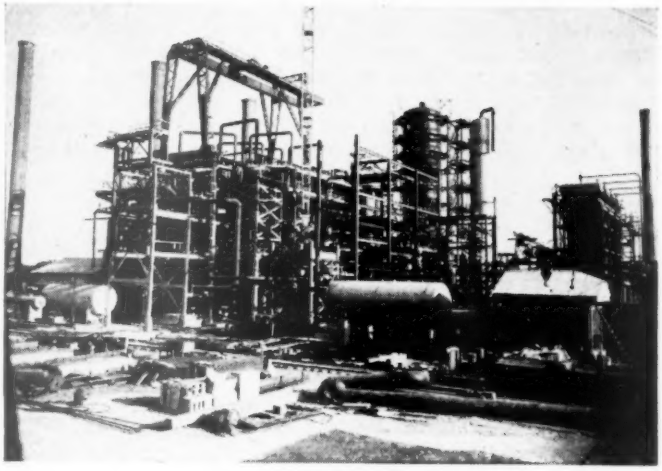
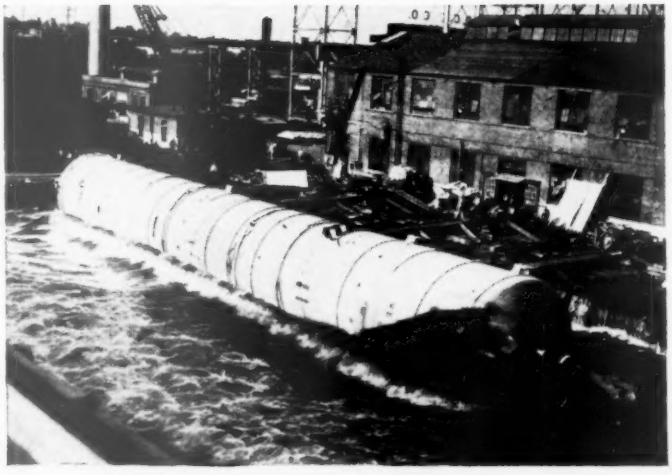



**Fig. 2—Diagram of metal losses in furnace tubes in heavy gas oil cracking coils Nos. 1 and 2. Furnace tube flow diagram in upper lefthand corner is to assit in locating arrangement of tubes in furnace**







Launching an 18 Foot Tower—Too Large for Rail Shipment—Was Shipped to Distant Refinery by Water.

# Oil Refining Equipment

**The Principal Pressure Vessels, Steel Plate Work and Special Equipment for these plants and many more were made in our plant at Chester, Pennsylvania.**

## Sun Shipbuilding and Dry Dock Co.

**Chester, Pa.**

**TABLE 2—Penetration Rates for Original Tubes of Heavy Gas Oil Cracking Coils**

| Sections | Coil No. 1 Tubes | Coil No. 1 IPY* | Coil No. 2 Tubes | Coil No. 2 IPY* |
|---|---|---|---|---|
| Preheater | 1-33, plain steel | 4/64-6/64 | ..... | ..... |
| Heater | 34-73, 1¼% Cr. | 10/64-20/64 | 34-75, 2% Cr. | 1/64-10/64 |
| Soaker | 74-112, 1¼% Cr. | 1/64-22/64 | 76-118, 2% Cr. | 1/64-3/64 |

*Inches penetration per year.

**TABLE 3—Penetration Rates for Original Tubes of Light Gas Oil Cracking Coils**

| Sections | Coil No. 1 Tubes | Coil No. 1 IPY* | Coil No. 2 Tubes | Coil No. 2 IPY* |
|---|---|---|---|---|
| Preheater | 1-51, plain steel | 2/64-4/64 | 1-51, plain steel | 1/64-9/64 |
| Heater | 52-117, 1¼% Cr. | 1/64-14/64 | 52-117, 2% Cr. | 3/64-14/64 |
| Soaker | 118-160, 1¼% Cr. | 1/64 Max. | 118-164, 2% Cr. | 1/64 Max. |

*Inches penetration per year.

for the visbreaking coils enter in a corrosive condition, making necessary the change from plain steel to 2% chromium steel tubes at an early date. For the latter material, recent losses have been relatively light in the preheater or convection sections. Increased severity of attack in the heater sections has made this alloy inadequate. The use of the more resistant alloy, 5% chromium steel, has been required in both coils at the higher temperatures.

Near the outlet of visbreaking coil No. 2, however, corrosion decreases and some original tubes, after eight years exposure, continue serviceable. Coke deposition in the two soaker sections is normally about the same. The evidence indicates that contact with the larger number of preheating tubes in coil No. 2 has caused removal of sufficient corrosive material from the oil to reduce or practically eliminate attack in the outlet section.

In addition to the greater penetration rate, the reason for the sharp rise in apparent metal loss for the last 30 tubes in coil No. 1 is that several of the lower alloyed tubes were tried in each position before resorting to a more resistant material. Had 5% chromium steel been used sooner for the last 30 tubes as was done for tubes No. 42 through 75, the cumulative loss would have been less, thus leveling the curve. This is also true for tubes No. 62 through 107 in coil No. 2 to a lesser degree.

It is obvious from the closely spaced pattern for the recent losses that excellent resistance now exists throughout the coils. Higher alloyed material has been installed at some locations to secure improved surface stability because of fire-side conditions in the furnace rather than because of internal corrosive attack.

As a matter of interest, the penetration rates for the original tubes are tabulated in Table 1. These are based for the most part on full tube life. In some cases excessive rates were experienced within a comparatively short time just prior to retirement, which resulted in the decision to use better material without awaiting further losses.

Somewhat similar conditions have existed in the heavy gas oil cracking coils for which patterns are shown in Fig. 2. Because of high corrosion losses in the plain steel in the preheater of heavy oil coil No. 1, replacements were first

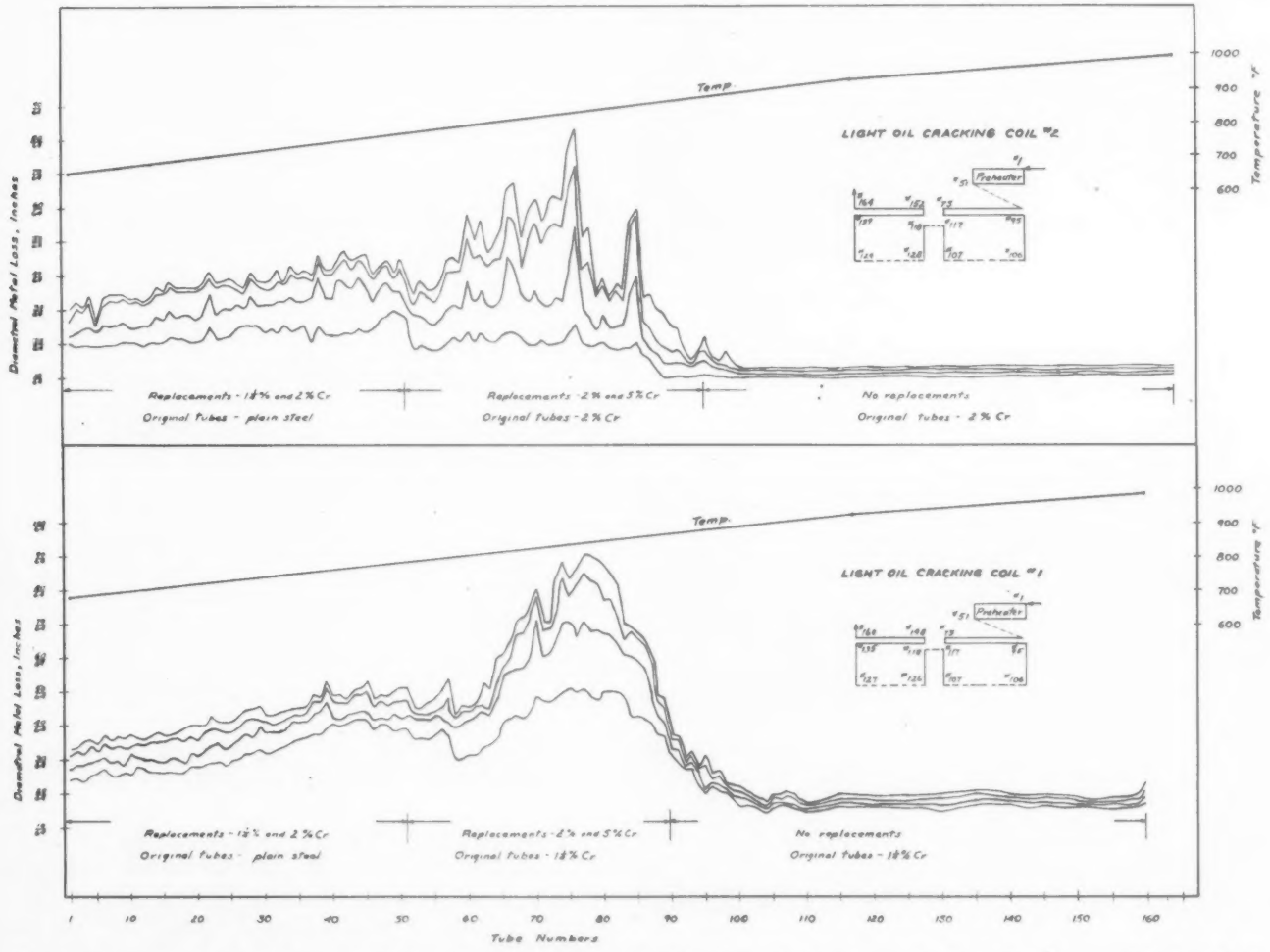



**Fig. 3—Diagram of metal losses in light gas oil cracking coils Nos. 1 and 2. Furnace tube flow diagram on right hand side is to assist in locating arrangement of tubes in the furnace**

# The Perfect Catalyst Carrier and Porocel

| *More Important Characteristics of the Perfect Catalyst Carrier* | **Porocel** |
|---|---|
| **1** *It shall accept and hold the catalyst tenaciously.* | **1** Porocel by adsorption and absorption holds large quantities of many inorganic salts and other compounds. The adsorbing activity of this naturally occurring adsorbent is greatly increased by simple thermal treatment. |
| **2** *It shall evenly disperse and present the catalyst to the reactants.* | **2** When the catalyst is impregnated on Porocel by one of several simple techniques, the catalyst is widely dispersed not only over the visible surfaces of the granules but throughout its capillary structure which is easily penetrated by gaseous and liquid reactants. |
| **3** *It shall form a rugged mass not readily altered by variations in temperature, pressure and flow conditions.* | **3** Porocel's extensive history of use, which includes continuous mechanical handling and highly satisfactory physical and chemical stability while subjected to wide ranges of temperatures, pressures and flow conditions, is a matter of record, a record we are always glad to make available. |
| **4** *It shall be inert and free from impurities which might affect the reaction.* | **4** While Porocel is an excellent catalyst in its own right for certain important types of reactions, its inert character in the great majority of cases has been noted. This is a factor which is readily verified. A new low-iron, low-silica grade now provides almost complete freedom from these occasionally troublesome impurities. |
| **5** *It shall be inexpensive and readily available commercially in various uniform sizes (meshes).* | **5** Only 2 to 4 cents per pound is the range of cost for this superior carrier, little more than would be paid for crude, impure minerals having little merit but cheapness. And Porocel is available in many standard meshes from 4/8 to 20/60 or in special meshes when required. |

Our experience in the field and the findings of our research staff have revealed many valuable facts about the importance of the carrier in any catalytic process. Often one of the several grades of Porocel can improve the product and reduce cost. These facts are available without obligation. Just write Attapulgus Clay Company (Exclusive Sales Agent), 260 S. Broad Street, Philadelphia 1, Pennsylvania.

**POROCEL CORPORATION**

BAUXITE ADSORBENTS AND CATALYSTS

made with 2% chromium alloy, which in turn is being replaced by the 5% chromium alloy. The change in spacing of the lines in the diagram is indicative of the revision. Similarly, high losses in the heater section have required ultimate installation of the better alloy. Later in the coil, the original 1¼% chromium steel tubes have given satisfaction. A few replacements were made with 5% chromium steel to resist severe firing conditions.

Heavy gas oil cracking coil No. 2 is not equipped with a convection bank of tubes. Therefore, the diagram was shifted to the right in order that the other two sections might correspond with those for coil No. 1. Corrosion experience has been approximately the same for comparable sections. The metal loss for neighboring tubes in coil No. 2 is more irregular. Part of the lack of uniformity may be attributed to the changing of random tubes at odd intervals for one reason or another. Here again coke deposition for both coils is relatively small in the heater sections and greater in the soaker sections.

Penetration rates for the original tubes partly indicate the reasons for installation of more resistant alloys. See Table 2.

The diagrams thus far described show the general trend of metal loss through out the furnaces, having been drawn by connecting the points plotted for approximately every fifth tube. Greater irregularity of pattern results when each measurement for every tube is plotted, as was done for the light gas oil cracking coils in Fig. 3. Discrepancies in calipering are undoubtedly reflected to a greater degree. However, there is a periodic rising and falling of the pattern in addition to its over-all upward or downward trend.

Fluctuation of one of the factors effecting corrosion has evidently occurred. Suspicion points to changes in turbulence of the flowing oil, although there is no further evidence to support it. In groups of tubes of the same analysis, it has been necessary to retire random members of the group without regard to their relative positions. As it does not appear likely that resistance would vary so extraordinarily in such a group, this could be viewed as an extension of the same hypothesis.

Greater similarity appears in the patterns for the two light oil coils than for the other pairs. The original tubes in some sections were attacked with severity, coil No. 2 having slightly higher rates. In the preheaters, the original plain steel was replaced by alloy material, as shown by the more closely spaced lines for the later measurements. The peak of the metal loss in the heater section occurs at approximately 820° F. for both coils.

Coke deposition in this section of each furnace normally is light, rarely requiring removal oftener than every six months and then mainly for inspection. Since this condition exists as far as tube No. 117, and corrosion decreases to almost zero some 20 tubes upstream from that point, there is evidence to support the belief that reduced metal loss results when the amount of corrosive material is decreased by chemical reaction along the path of flow. Despite higher temperatures later in the coils there is little or no metal loss.

Following installation of 5% chromium steel tubes in the most severely attacked sections, there has been a noticeable increase of the penetration rate downstream in the less resistant material. Note the effect on the spacing of the pattern lines for tubes No. 87 through 92 in light oil coil No. 2, after installing the higher alloyed steel for tubes No. 80 through 86. The date of installation is shown by the lines becoming more closely spaced in that region. A sufficient number of the 5% chromium steel tubes has not been installed to protect the entire section. Hence, the effect of releasing all corrosive constituents for action in the soaker section, where coke deposits are usually heavy, has not yet been tested. As revealed in the diagram, these later tubes have experienced very light corrosion thus far.

Comparative penetration rates for the original tubes are tabulated in Table 3.

Summarizing, a method of describing corrosion experience by means of patterns has been explained. These patterns are made by plotting on suitable graphs the annual measurements of the inside diameters in the tubes of cracking coils. Typical examples of such diagrams are presented and the salient features brought out. Indications of the effect of temperature, turbulence, and coke deposition, dependent upon the positions of the tubes in the furnaces, are given.

Reduction of metal loss resulting from decreased corrosive material through chemical reaction along the path of flow is apparent. The relative resistances of the several alloys and plain steel, as well as their annual penetration rates, may be determined from the patterns. The penetration rates for the original tubes are tabulated for comparison.

## NEW BOOKS FOR THE REFINER

### New Plastics Book Covers Fundamentals of Subject

*The Technology of Plastics and Resins*, by J. Philip Mason and Joseph F. Manning; 6 x 9 in., 493 pages, stiff cloth binding, indexed and illustrated, $6.50.

Many texts have been published on plastics and resins, but most of them have been written either for persons who were assumed to understand the fundamental chemistry of the subject, or for persons who were interested primarily in the practical applications of the materials. For the most part they have devoted too little space to the basic chemistry involved in the preparation of plastics and resins.

Recognizing this lack of available material on the subject, the authors of *The Technology of Plastics and Resins* have undertaken to prepare a book which they believe is suitable for persons who have had only introductory courses in general and organic chemistry, and which will serve as an adequate introduction to both the chemistry and the practical utilization of plastics and resins.

The subject is dealt with in three distinct phases. The first covers the theoretical and general aspects of plastics and resins. In this part terms are explained, types and mechanisms of polymerization are discussed, and the relationship between various physical properties and the structure of plastics and resins is presented.

Methods of preparation and the properties and uses of the more important resins and plastics are discussed in the second section.

Section three contains a discussion of fabrication techniques, compounding and mold designs, together with molding, casting, laminating and coating procedures.

The authors, J. Philip Mason, Ph. D., and Joseph F. Manning, Ph. D., are both on the staff of Boston University. Dr. Mason is professor of chemistry; Dr. Manning lectures on chemistry and is also research chemist for the B. B. Chemical Co.

### Monograph Gives Organization Of Industrial Research Group

*Organization of Technical Research in Industry*, a monograph prepared by the Industrial Research Institute, 6 x 9 in., paper cover, 16 pages.

An outline for the organization of an industrial research laboratory is presented in a recently published monograph, Organization of Technical Research in Industry, prepared by a committee of the Industrial Research Institute. Although specific research problems vary widely from one industry to another, there are certain broad principles which are fundamental to most research organizations. It is these principles which the monograph considers.

Subjects covered include the size of the budget, specialization within the group (research, process development, products service), library and patent work, cost of personnel, set-up of organization, and the place of research in the company.

Copies of the monograph may be obtained without charge by writing to C. G. Worthington, secretary of the Industrial Research Institute, 60 East 42nd St., New York 17.

# POWELL VALVES for Oil Well and Refinery Service

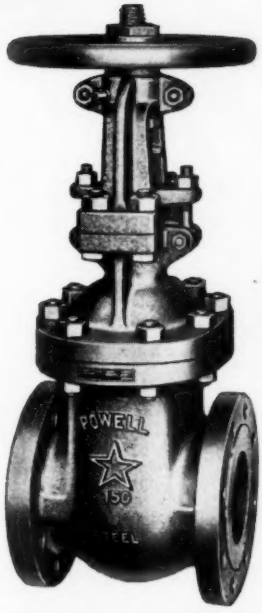
For 100 years Powell has been making valves to meet every new demand imposed by the amazing developments in every branch of American Industry.

That is why today Powell can offer the Petroleum Industry a complete and superior line of valves that satisfy the requirements of every flow control service from oil well to refinery. This includes Bronze and Iron Valves of all necessary types and pressures; Steel Valves for pressures from 150 to 2500 pounds and temperatures up to 1400 F., and a complete line in pure metals and special alloys to resist all corrosive media encountered in the various processes employed in the Industry.

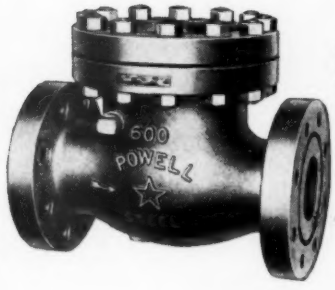
**The Wm. Powell Co., Cincinnati 22, Ohio**

**DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES**

125-150-pound Iron Body Bronze Mounted or All Iron "Master Pilot" Gate Valve.

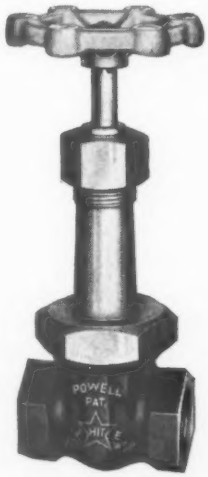



Class 150-pound Cast Steel O. S. & Y. Gate Valve. Powell Cast Steel Valves are available in all pressure classes from 150 to 2500 pounds, inclusive.

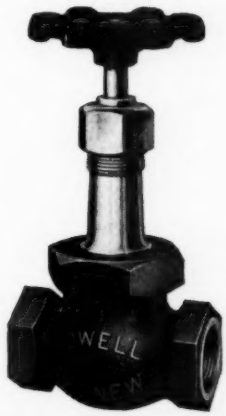



Class 600-pound Cast Steel Swing Check Valve with Ring Type Joint End Flanges.

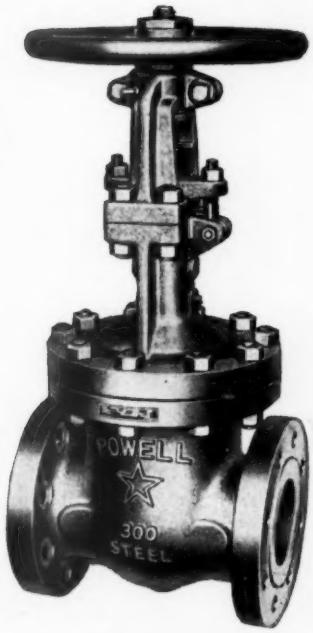
125-pound Iron Body Bronze Mounted or All Iron O. S. & Y. Gate Valve.




200-pound Bronze Gate Valve with renewable wear- resisting taper wedge disc.



150-pound Iron Body Bronze Mounted or All Iron "Irenew" Globe Valve.




Class 300-pound Cast Steel O. S. & Y. Gate Valve.

# POWELL VALVES

# T.A.C. FINALE IS ON A NOTE OF VICTORY

FINAL meeting of the Technical Advisory Committee of the Petroleum Industry War Council took place Nov. 12 in the Continental Hotel in Chicago. Present were members of the committee, alternates, sub-committee members, former members of the Refining Division of PAW at Washington and a few guests.

Gone entirely on this occasion was the tense atmosphere in which were held many sessions of this group of oil company technologists who served as the liaison between PAW and hundreds of refineries over the country on the wartime refining program. Their contribution to the Allied victory was a most important one; they overcame many knotty technological problems in working out the methods for the refineries' large volume production of synthetic rubber, aviation gasoline, toluene and other wartime petroleum products.

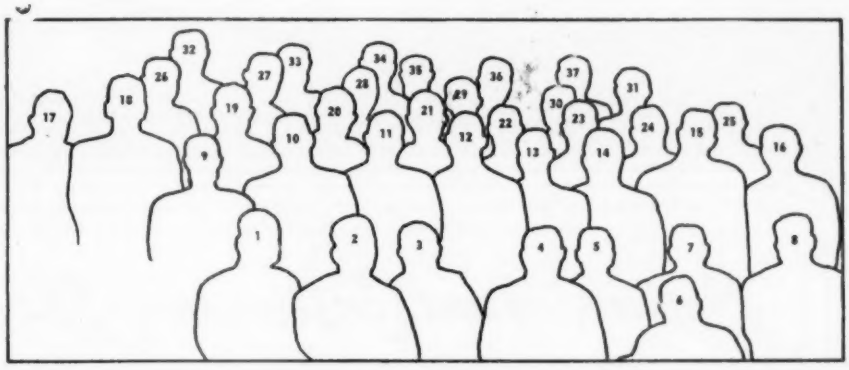
Now the time had come to celebrate their accomplishments in their own way. There were speeches—very short ones—by a few members, who were appropriately introduced by pictures furnished by K. G. Mackenzie and thrown on a screen. A. E. Miller, TAC secretary, sang some of his well known songs and played original recordings on a phonograph. Chairman T. G. Delbridge presided in his usual effective manner.

The arrangements for TAC's Victory Dinner were made by Pure Oil Co. and the photographs, of which the accompanying are only a few, were taken by Harry Langdon, photographer of Pure's Research and Development Laboratories at Winnetka, Ill.

**The three ringmasters of TAC's "dog and pony" show. Chairman T. G. Delbridge (center), Vice-chairman K. G. MacKenzie (right) and Secretary Albert E. Miller (left) spent much time over the country, working with PAW's district committees on refining. These traveling groups were dubbed the "dog and pony" show**

**Five former PAW members get together at the TAC finale. Left to right: William R. Argyle, former assistant director in PAW's Refining Division; Robert B. Cragin, another former assistant director; Major R. W. Pachaly (now discharged); A. P. Frame, former Refining Division director; and Robert M. Cornforth (ex-Major), former executive secretary of the Aviation Gasoline Advisory Committee**

**Identification of the individuals in the TAC group picture on the facing page is given below, the numbers corresponding to the numbers in the diagram at the right**



1—K. G. Mackenzie ..... The Texas Co.
2—H. W. Field ..... Atlantic Refining Co.
3—A. P. Frame ..... Petroleum Advisors
4—W. B. Ross ..... The Pure Oil Co.
5—T. G. Delbridge .... Atlantic Refining Co.
6—P. J. Harrington, Standard Oil Develop. Co.
7—A. E. Miller ..... Sinclair Refining Co.
8—A. H. Hand ..... A. P. I.
9—H. D. Wilde ... Humble Oil & Ref. Co.
10—E. C. Herthel ..... Sinclair Refining Co.
11—Eugene Ayers ... Gulf Res. & Develop. Co.
12—W. B. Bradley ..... Union Oil Co.
13—David E. Day ..... Richfield Oil Corp.
14—Walter Miller ..... Continental Oil Co.
15—R. A. Halloran ..... Calif. Res. Corp.
16—J. P. Cunningham .... Shell Develop. Co.
17—W. R. Argyle ..... Sinclair Refining Co.
18—R. J. Askevold ..... Pure Oil Co.
19—J. K. Roberts .... Standard Oil Co. (Ind.)
20—G. C. Cunningham ..... Shell Oil Co.
21—J. M. Forrester ... Standard Oil Co. (Ind.)
22—J. T. McCoy ... Tide Water Assoc. Oil Co.
23—E. W. Isom ..... Sinclair Refining Co.
24—J. A. Scott ..... Sinclair Refining Co.
25—A. C. Lazar ... Tide Water Assoc. Oil Co.
26—E. B. McConnell Standard Oil Co. (Ohio)
27—R. B. Cragin ..... Houdry Process Corp.
28—W. J. Sweeney Standard Oil Develop. Co.
29—L. L. Davis ..... Continental Oil Co.
30—R. C. Alden ..... Phillips Petroleum Co.
31—Maj. R. W. Pachaly ..... P. A. W.
32—G. G. Oberfell .... Phillips Petroleum Co.
33—J. Bennett Hill ..... Sun Oil Co.
34—R. M. Cornforth ..... P. A. W. (ex Major)
35—G. R. Lord ..... Sinclair Refining Co.
36—J. B. Rather .... Socony-Vacuum Oil Co.
37—G. L. Matear ... Cities Service Ref. Corp.

UNITS WE HAVE DESIGNED AND BUILT SINCE COMPLETING OUR WAR PROGRAM:
3 CRACKING PLANT TUBE FURNACES
1 CONVERSION TO THREE STAGE THERMAL CRACKING
5 ABSORPTION PLANTS
6 COMPRESSOR STATIONS OR EXTENSIONS
1 CRUDE STABILIZER
1 FIVE COLUMN LIGHT PRODUCT FRACTIONATING SYSTEM
2 TWO COLUMN LIGHT PRODUCT FRACTIONATING SYSTEMS
3 ONE COLUMN LIGHT PRODUCT FRACTIONATORS
2 GAS DEHYDRATION SYSTEMS
1 GASOLINE SWEETENER
MINOR REFINERY, GASOLINE PLANT AND FIELD EXTENSIONS

We serve the Industry that makes possible all modern modes of transportation

*Engineering and Construction Division*

**JONES & LAUGHLIN SUPPLY COMPANY**

**TULSA, OKLAHOMA**

# Peace-Time Utility of War-Time Petroleum Refining Processes

*By F. D. Parker, Development Engineer*

General technico-economic considerations in the operation of the war-time refining processes in the production of motor gasoline are discussed, although it is recognized that the problem must ultimately be solved in the light of conditions faced by the individual refiner. The processes the refiner can call upon to manufacture post-war motor fuels of from 3 to 8 octane numbers above pre-war levels are alkylation, isomerization, catalytic cracking and to a lesser extent catalytic polymerization and catalytic reforming.

Refineries in the 5000-50,000 b/d crude oil charge capacity group are considered, as a group, most concerned with the application of the war-time processes to post-war operations and the weighted average of their actions therefore most significant in setting product quality levels. By making generalized data on yields and costs, figures have been set up showing the value of products as a function of plant capacity and charge stock cost. While it is concluded from these studies that catalytic cracking is the most generally applicable peace-time process, conditions are described under which alkylation and isomerization may be economically justifiable in motor fuel manufacture.

WITH the successful completion of the war against the Axis nations, the petroleum industry's major task changes from the production of war materials to the production of fuels, lubricants and specialties required by industry and the consumer public. The following figures, abstracted from recent reports, indicate the size of the task performed by the refining branch of the industry and the magnitude of the reconversion problem in terms of capital equipment involved.

1. Prior to the war, the production of 100 octane gasoline in the U. S. was about 46,000 b/d. In four years, this was increased to about 525,000 b/d. This involved operation of a relatively small number of pre-war units, plus construction and operation of many new units, the latter running about as follows (for the United Nations, with most of the plants in the U. S.):

| Type Plant | Approx. No. Units |
|---|---|
| Alkylation | 75 |
| Catalytic Cracking | 77 |
| Isomerization | 37 |
| Hydrogenation | 4 |
| Dehydrogenation | 2 |
| Miscellaneous | 16 |

2. The petroleum industry and government spent approximately $1,000,000,000 on facilities related to the production of 100-octane aviation gasoline. Of this amount, about $850,000,000 was spent for facilities within the continental U. S., $620,000,000 of it by private industry.

3. Some of the facilities constructed in connection with the toluene program and the $800,000,000 synthetic rubber program (both largely government financed) have potential peace-time applicability.

The utility of the war-built plants in the manufacture of peace-time refined products is of interest not only to the refiners who installed one or more of these units for the production of aviation gasoline, but also to those refiners who, through consideration of individual economic, geographical, or transportation factors were not in a position to participate in the 100-octane program, or phases of the toluene and synthetic rubber programs, and now find themselves entering the postwar period with prewar refining facilities operating in competition with more modern facilities of other refiners. While the problem of what plants can be operated economically is one that must ultimately be reviewed by each individual refiner in the light of conditions peculiar to his situation, there are certain more or less general technico-economic considerations which it is the purpose of this paper to review.

### Predicted Gasoline Production, Quality

Considerable thought has been given by various analysts to the quantity and quality of postwar gasoline.

R. W. Reinhart[1] presents figures on past and predicted future gasoline consumption in the U. S. as follows:

| Year | Million Bbls./Yr. |
|---|---|
| 1935 | 450 |
| 1936 | 475 |
| 1937 | 515 |
| 1938 | 525 |
| 1939 | 550 |
| 1940 | 590 |
| ... | ... |
| 1945 | 599 |
| 1946 | 640 |
| 1947 | 700 |
| 1948 | 745 |
| 1949 | 756 |

Burrill[2] is in general agreement with the above predicted post-war figures. While disturbances in the war-peace transition will undoubtedly cause marked deviations from the 1945-1946 figures, the predicted consumption for 1947-1949 appears sound.

Risk[3] reports distribution of various quality gasolines for the prewar and predicts postwar distribution as given in Table 1.

There is a strong feeling in the aviation industry that a considerable portion of the aviation gasoline cited by Risk as averaging 100-octane will actually be of super-fuel quality such as alkylate-plus-isopentane-plus-lead. This will have a bearing on the economic operability of processes like alkylation and isomerization. Actual marketing trends show that regular grade and premium grade motor gasolines are, in many cases, already in the above predicted range.

Refinery capacity figures are reported[4] as follows:

| Year | Crude Oil Charge Capacity, B/D |
|---|---|
| 1935 | 3,700,000 |
| 1936 | 3,850,000 |
| 1937 | 3,900,000 |
| 1938 | 3,900,000 |
| 1940 | 4,200,000 |
| 1941 | 4,500,000 |
| 1943 | 4,500,000 |
| 1944 | 4,700,000 |
| 1945 | 4,850,000 |

Referring to the above figures, it is evident that the petroleum refining industry is faced with the problem of producing motor gasolines 3-8 octane points above pre-war values with yields of gasoline from crude oil equal to or exceeding pre-war yields. From the point of view of number of installations, the most important war-time processes available for solving this refining problem are alkylation, isomerization, and catalytic cracking. Catalytic polymerization and catalytic reforming (hydroforming) are prewar processes whose applicability to post-war operations is also of interest.

### War-Time Processes Available For Peace-Time Operations

As previously noted, the major private petroleum industry investment in new refining facilities during the war years was for high octane gasoline plants and related auxiliaries. Papers describing the various catalytic cracking processes[5, 6, 7, 8], alkylation [9], butane and pentane-hexane isomerization[10] and hydroforming (including toluene purification)[11, 12], and integration of certain of these processes for high octane gasoline manufacture[13] have given adequate coverage of their respective subjects. Therefore, in this paper no attempt will be made to recapitulate previously published characteristic features of process, technology, operation, and refinery integration except

*Presented before the annual meeting of the California Natural Gasoline Assn., Los Angeles, Oct. 12, 1945.*

as pertinent to the considerations at hand.

The significant items that are the concern of this paper are summarized in Table 2.

While the above processes are available to all refiners for postwar operation, the size of any installation will vary with the crude oil charge capacity, the nature of the crude processed, the products normally manufactured, and the details of existing process facilities and operations. As a matter of interest in determining the approximate size of individual modern refining units that might be operated for peace-time products, continental U. S. refineries may be segregated into the crude oil charge capacity groupings shown in Table 3.

The figures in Table 3 indicate that refineries in the 1000-5000 b/d range predominate numerically, but have total charge capacity only above 8.0% of the U. S. total. Refineries over 50,000 b/d capacity represent 45% of total U. S. crude capacity, but are few in number, and in most cases owned by companies whose problems are handled individually and whose economic position, due to size, generally permits them to operate any or all of the processes installed by smaller refiners. The 5000-50,000 range includes about 40% of the refineries and 46.6% of the crude oil charge capacity. Refineries in the 5000-50,000 b/d range will therefore, as a group, be most concerned with the applicability of war-time refining processes to post-war operations, and the weighted average of their actions is most significant in setting product quality levels.

In considering catalytic cracking, alkylation, isomerization and the like in the light of peace-time conditions, it is convenient to estimate the approximate capacity ranges for each as related to refinery crude oil charge capacity. For purposes of this paper, three typical refinery capacities have been selected for illustrating the effect of plant capacity on economics. These refinery capacities are 5000 b/d, 15,000 b/d, and 30,000 b/d corresponding to significant 5000-50,000 b/d range described above.

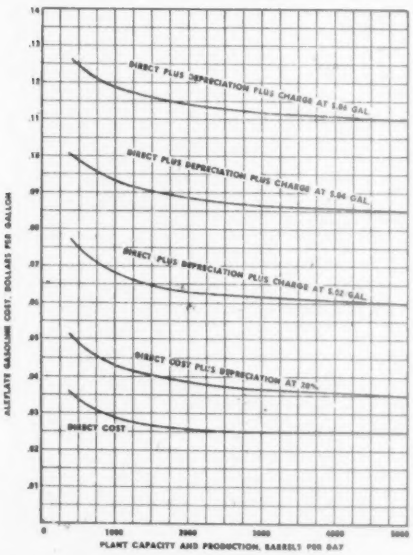

DIRECT PLUS DEPRECIATION PLUS CHARGE AT 5.04 GAL.
DIRECT PLUS DEPRECIATION PLUS CHARGE AT 5.04 GAL.
DIRECT PLUS DEPRECIATION PLUS CHARGE AT 5.02 GAL.
DIRECT COST PLUS DEPRECIATION AT 20%
DIRECT COST
ALKYLATE GASOLINE COST, DOLLARS PER GALLON
PLANT CAPACITY AND PRODUCTION, BARRELS PER DAY

**Fig. 1—Typical alkylate gasoline costs as a function of plant capacity and charge cost**

TABLE 1—Pre-War and Predicted Post-War Gasolines

| Grade | Octane Rating ASTM Motor: Pre-war | Octane Rating ASTM Motor: Post-war | % of Total Gasoline: Pre-war | % of Total Gasoline: Post-war |
|---|---|---|---|---|
| Aviation | 91-100 | 100 | 2 | 6- 8 |
| Premium | 80 | 85-88 | 10 | 10-20 |
| Regular | 75 | 78-80 | 78 | 60-75 |
| Third Grade | 64 | 68-70 | 10 | 5-15 |

TABLE 2—Charge, Product and Approximate Volume Yield of War-Time Processes

| Process | Charge | Product | Approx. Volume Yield |
|---|---|---|---|
| Catalytic Cracking | Narrow or wide-boiling virgin coke distillate, or visbreaker gas oil, or deasphalted resid. | Gasoline 78-82 ASTM 88-95 Research | 40-65% |
| Alkylation | Olefins: Propene, Butenes, Pentenes, Polymer Isoparaffin: Isobutane | Alkylate Gasoline 88-94 ASTM 88-96 Research | 160-170% on Olefin |
| Polymerization | Propene, Butenes | Polymer Gasoline 85-95 ASTM **95-105 Research** | 65-75% on Olefin |
| Butane Isomerization | **Normal Butane** 92 ASTM | Isobutane **(for alkylation)** | 100% |
| Pentane Isomerization | Normal Pentane 62 ASTM | Isopentane 92 ASTM | 96-100% |
| Catalytic Reforming (Hydro-forming) | Naphtha 45-55 ASTM | Gasoline 75-82 ASTM 80-90 Research | 75-90% |

On the above basis, and by making use of generalized yields data characteristic of processing a typical 31° API Los Angeles Basis crude oil[13] it is possible to set up figures which will approximately bracket the range of individual plant capacities corresponding to the 5000 b/d, 15,000 b/d, and 30,000 b/d refineries chosen for illustrative purposes. These are summarized in Table 4.

The relatively wide range shown is explainable by the variety of refinery processing schemes and flexibility of operating conditions.

### Relative Economics

The following discussion presents the results of some comparative studies of alkylation, isomerization, catalytic cracking, and other operations for motor gasoline production.

It is recognized that it is not possible to present firm figures applicable to every refiner's situation, since plant investment and operating cost, product yields and qualities, and charge stock and product values vary widely. However, by averaging typical data for each process, and prorating direct and indirect charges, it is possible to set up curves showing value of product from each process as a function of plant capacity, and charge stock cost. Refinery overhead and management charges, and taxes and interest are not considered in this study, since they vary widely through the industry. With the understanding that the calculated figures are relative rather than absolute, it is then possible to draw some conclusions regarding utility of each war-time process in peace-time operations.

The basic figures used or considered in these comparative studies are given in Table 5.

### Alkylation

Alkylation of olefins with isoparaffins to form high-octane gasoline components is not strictly a "war-time" process. The first commercial unit started operations in 1938, but by far the majority of the present 60 plants (sulfuric acid and HF acid processes) were constructed during the war. The alkylation process contributed significantly to the 100-octane aviation gasoline program with alkylate production reaching about 130,000 b/d[15]. Applicability of the process to postwar motor gasoline operation is, of course, dependent on competitive economics.

Fig. 1 presents typical calculated alkylate gasoline costs as a function of alkylation plant capacity and raw material cost.

The data in Table 6 abstracted from Fig. 1 summarize costs for two "extreme" conditions.

With alkylate in average blends of 79 ASTM regular and 86 ASTM premium gasolines carrying a lead credit of 3-4 cc. per gal. (0.6-0.8c per gal.) and with re-

finery netbacks of 6c per gal. and 7c per gal. respectively for regular and premium gasolines, it is possible for even a relatively small refiner to produce alkylate economically for premium gasoline provided the charge stock to the process is worth 2c per gal. ($.84 per bbl.) or less.

A large refiner could probably blend this alkylate to 6c regular gasoline. This would in general, limit the olefin charge stock to excess butenes beyond those which the refiner can use directly in motor gasoline as limited by vapor pressure specifications, and to propene. Similarly, isobutane from natural gas and gasoline and cracking operations (at about 2c per gal., where so available) rather than isobutane synthesized from normal butane is called for. Since the operation is close to marginal, detailed study of each individual case is required.

### Butane Isomerization

Isomerization of normal butane to isobutane is a process closely related to alkylation, since it provides a means for augmenting the supply of isobutane where this material is not available in sufficient quantity from natural gasoline or refinery stocks to meet alkylation requirements as determined by olefin availability. The first commercial butane isomerization unit started operation in 1940; by far the major number of units were installed during the period 1941-1945.

Fig. 2 presents calculated costs of isobutane as a function of plant capacity and normal butane charge cost. These figures are averages of typical isomerization plant costs and should not be construed as rigorous nor necessarily applicable to any particular process or installation. However, they indicate generally the economics of the process. For example, refiners contemplating the operation of alkylation plants for the production of motor gasoline components, and faced with a shortage of isobutane, could produce isobutane from available normal butane in field and refinery stocks at the approximate costs shown in Table 7.

Referring to Fig. 1 for alkylate gasoline costs, it will be noted that each 1.0c per gal. increase in charge stock cost raises the alkylate product cost about 1.25c per gal. If alkylation plant olefin charge and normal butane are both available at 2.0c per gal., the isobutane produced by isomerization for reaction (with olefin to form alkylate) will cost 2.6-4.0c per gal. and the average charge to the alkylation plant will cost 2.3-3.0c per gal. (on the approximate basis of equal volumes of isobutane and olefin reacting). The alkylate gasoline will, therefore, cost 0.38-1.25c per gal. more than if 2.0c per gal. isobutane were available from field sources or cracking.

From the above it appears that butane isomerization is a marginal operation, and its applicability a function of isomerization and alkylation plant capacities, extent of amortization of each, cost of field or refinery butane as related to fuel gas and liquefied petroleum gas market prices, and outlet for alkylate (in aviation, premium, or regular grade motor gasolines) and hence value of alkylate.

### Pentane Isomerization

Commercial isomerization of normal pentane to produce isopentane is truly a war-time process, the first unit starting operation in 1944.[16]

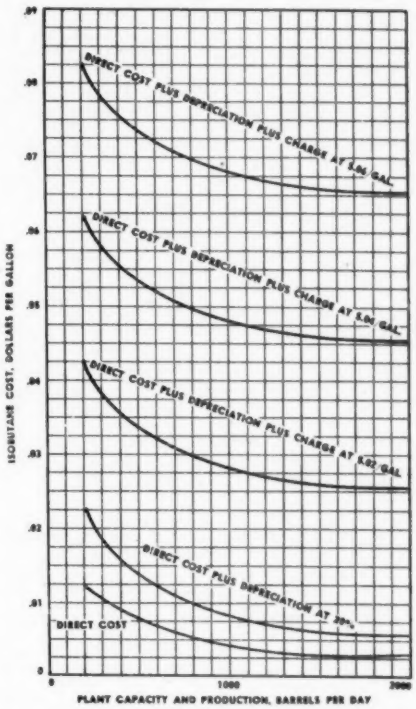



**Fig. 2—Typical isobutane costs as a function of isomerization plant capacity and charge cost**

Fig. 3 presents calculated economics for the process. As in the case of butane isomerization, there are a number of processes available, each with characteristic features and economics so that the cost information of Fig. 3 is necessarily a rough average only, and not necessarily applicable to any particular process or refinery situation. Fig. 3 indicates refiners processing about 5000 b/d and 30,000 b/d of crude oil respectively can produce isopentane at the approximate costs shown in Table 8.

With 79 ASTM housebrand gasoline at a refinery net-back of 6.0c per gal. and normal pentane charged to the process at a value of 5.7-5.9c per gal. (account lead penalty) a large refiner can consider pentane isomerization since isopentane can be produced at a cost including depreciation, in the neighborhood of 6.9c per gal., which is about the calculated refinery net-back for 6c regular grade gasoline plus lead credit for the high-octane of isopentane. In a typical premium blend the normal pentane is worth about 6.4-6.6c per gal., the resultant isopentane costs about 7.6c per gal., is worth about 7.9c per gal., and the economics are more favorable.

The above figures are altered when including a penalty for vapor pressure. For example, normal pentane and isopentane have vapor pressures of 15.5 psi and 21.0 psi respectively. Each volume of normal pentane can, therefore, carry about .15 volumes of normal butane and the mixture have a vapor pressure of 21.0 psi.

The isopentane product therefore

**TABLE 3—Approximate Distribution of U. S. Refining Capacity[14]**

| Individual Refinery Crude Oil Charge Capacity Barrels per Day | Approximate Number of Refineries | % of Total U. S. Refineries | Approximate Crude Oil Processed, b/d | Crude Oil, % of U. S. Total |
|---|---|---|---|---|
| Less than 1,000 | 53 | 13 | 20,000 | 0.4 |
| 1,000- 5,000 | 162 | 41 | 400,000 | 8.0 |
| 5,000- 10,000 | 71 | 18 | 480,000 | 9.6 |
| 10,000- 25,000 | 59 | 15.1 | 850,000 | 17.0 |
| 25,000- 50,000 | 28 | 7.2 | 1,000,000 | 20.0 |
| 50,000-100,000 | 13 | 3.3 | 950,000 | 19.0 |
| 100,000 plus | 10 | 2.5 | 1,300,000 | 26.0 |
| | 396 | 100.0 | 5,000,000 | 100.0 |

**TABLE 4—Approximate Range of Individual Plant Capacities**

| Process | 5,000 b/d Refinery | 15,000 b/d Refinery | 30,000 b/d Refinery |
|---|---|---|---|
| Thermal or Catalytic Cracking | 2,000-4,000 (3,000 av.) | 6,000-12,000 (9,000 av.) | 12,000-24,000 (18,000 av.) |
| Alkylation (Alkylate Gasoline) | | | |
| Propene | 200- 300 | 600- 900 | 1,200- 1,800 |
| Butene | 200- 300 | 600- 900 | 1,200- 1,800 |
| Pentene | 200- 300 | 600- 900 | 1,200- 1,800 |
| Total Alkylation | 600- 900 | 1,800- 2,700 | 3,600- 5,400 |
| Propene-Butene Polymerization | 150- 250 | 450- 750 | 900- 1,500 |
| Butane Isomerization | 100- 500 | 300- 1,500 | 600- 3,000 |
| Pentane Isomerization | 50- 200 | 150- 600 | 300- 1,200 |
| Catalytic Reforming (Hydroforming) | 1,000-1,500 | 3,000- 4,500 | 6,000- 9,000 |

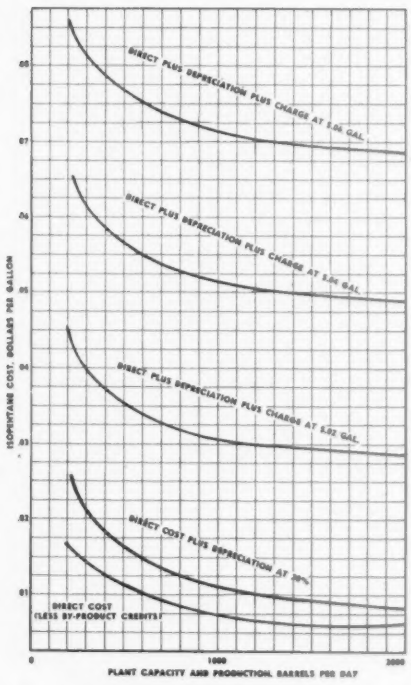

DIRECT PLUS DEPRECIATION PLUS CHARGE AT 6.0c GAL.
DIRECT PLUS DEPRECIATION PLUS CHARGE AT 5.0c GAL.
DIRECT PLUS DEPRECIATION PLUS CHARGE AT 4.0c GAL.
DIRECT COST PLUS DEPRECIATION AT 20%
DIRECT COST (LESS BY-PRODUCT CREDITS)
ISOPENTANE COST, DOLLARS PER GALLON
PLANT CAPACITY AND PRODUCTION, BARRELS PER DAY
0
1000
2000

**Fig. 3—Typical isopentane costs as a function of plant capacity and charge cost**

carries a penalty 0.3-0.6c per gal. (depending on butane value) for volume reduction in "gasoline-plus-butane" that can be made without exceeding vapor pressure specifications. On this basis, the isomerization process can be operated with about a 5-year write-off if plant capacity and production are of the order of 1200 b/d, corresponding to a 20,000-30,000 b/d refinery as defined in this paper.

The same general concepts apply to isomerization of heavier components such as hexanes and heptanes. While commercial operation of the latter process has not been as extensive as have butane and pentane isomerization, it is possible that future developments will prove that these are economical methods for octane improvement.

It should be noted in this connection that at the present time all of the isomerization processes require relatively pure charge stocks and the cost of preparation of same has not been included in the cost of Fig. 3. Thus, it is not possible for a refinery to charge a cracked $C_5$ fraction containing isopentane, normal pentane and pentenes. Normal pentane and isopentane can be charged together, but the $C_5$ fraction from cracking operations must be processed, as in an alkylation plant, to remove the olefins prior to isomerization. The economics of pentane isomerization are, therefore, closely related to the overall economics of the particular refiner, including his alkylation plant capacity and the cost of operation at various production rates.

Isomerization of pentane, hexane, and heptane as an adjunct to natural gasoline processing appears to warrant consideration provided sufficient charge stock is available at a central point. Thus, if normal pentane is present in natural gasoline to the extent of 15%, and a 1000 b/d pentane isomerization plant is considered as an economic minimum, the isomerization process would be applicable to a natural gasoline plant handling some 280,000 gal. day of casinghead.

### Catalytic Cracking

Catalytic cracking, of which about 1,000,000 b/d potential charge capacity was installed during the war, represents the major industry investment, and the prime factor in determining industry-wide average octane rating of motor gasolines because of the relatively high ratio of catalytic cracking capacity to crude oil distillation capacity. As is well known from published information on the various catalytic cracking processes, each has characteristic technological and operating features which show up in product yields and qualities, investment costs, and operating costs.

Furthermore, economics of catalytic cracking are, of course, related not only to size of installation, but to type of charge stocks available, number and quality of products other than motor gasoline that it is desired to produce, availability of means (such as alkylation or polymerization) for utilizing light fractions (gas, propene-propane, butene-butane, etc) refinery utility balances and costs, market demand and prices for gasoline, distillate, and residual products, and competitive gasoline quality level.(17)

In a general paper of this type, it is not the intention to cover all the above points, but rather to illustrate the general economic applicability of catalytic cracking. Using typical data for recycle cracking California stock (50-60% yield), Fig. 4 has been prepared to show the calculated cost of catalytically cracked gasoline as a function of reactor fresh feed capacity and throughput. The following basis for charge and credits was used:

| | |
|---|---|
| Gas Oil Charge | $1.25 bbl. |
| Catalytic Fuel Oil | 0.90 bbl. |

**TABLE 5—Basic Costs and Product Values**

| | |
|---|---|
| **Direct Costs** | |
| Labor | |
| Operating Labor | 1.30/man-hour |
| Direct Supervision | 25% of operating labor |
| Maintenance | 3-5% of plant investment per year |
| Utilities | |
| Steam (High pressure) | $0.18/1000 lbs. |
| Steam (exhaust) | $0.08/1000 lbs. |
| Power | $0.005/kw. |
| Fuel | $0.13/Million BTU |
| Cooling Water | $0.005/1000 gal. |
| Treated Water | $0.05/1000 lbs. |
| Chemicals | Market or manufacturers' prices |
| Royalties | Estimated licensors' "running" basis |
| **Indirect Costs** | |
| Depreciation | 20% of plant investment per year |
| **Charge Costs and Product Values** | |
| Propane-Propene | 2-6c/gal. |
| Butane-Butene | 2-6c/gal. |
| Pentane-Pentene | 2-6c/gal. |
| Virgin Gas Oil | $1.25/bbl. |
| Catalytically Cracked Gas Oil | $ .90/bbl. |
| Housebrand Gasoline (79 ASTM octane) | 6c/gal. |
| Premium Gasoline (86 ASTM octane) | 7-7½c/gal. |
| Tetraethyl lead (including leading cost) | $0.002/cc |

| | |
|---|---|
| Butanes | 0.84 bbl. (2c/gal.) |
| Dry Gas ($C_3$ and lighter) | 0.13 Million Btu's |

The approximate costs for debutanized catalytically cracked gasoline as summarized from Fig. 4 are given in Table 9.

The catalytic cracking operation is shown by the above figures to be attractive, since even when using conservative charge cost and by-product credits, the 78-82 octane catalytic gasoline can be produced at a cost including depreciation below the 6.0c per gal. netback for 79-octane regular gasoline used in this study. Furthermore, the catalytic gasoline can be leaded to 86 ASTM premium grade (at a refinery net-back of 7c per gal.) with about 0.6-1.0 cc. TEL per gal. (raising the gasoline cost only .12-20c per gal.) as compared to the maximum of 75-79 octane that can be reached by heavy leading (2-3 cc. per gal.) of thermally cracked or reformed stocks.

In addition to the catalytic gasoline,

**TABLE 6—Summary of Costs for Alkylation**

| | Alkylate Cost—Cents per Gallon | |
|---|---|---|
| | Small Refiner (5,000 b/d ± Crude 500 b/d ± Alkylate) | Large Refiner (30,000 b/d ± Crude 2,500 b/d ± Alkylate) |
| Direct Cost | 3.3 | 2.6 |
| Direct Cost plus deprec. (@ 20%) | 4.9 | 3.8 |
| Direct Cost plus deprec. plus charge (@ 2c per gal.) | 7.4 | 6.3 |
| Direct Cost plus deprec. plus charge (@ 4c per gal.) | 9.9 | 8.8 |
| Direct Cost plus deprec. plus charge (@ 6c per gal.) | 12.4 | 11.3 |

**TABLE 7—Summary of Costs for Butane Isomerization**

| | Isobutane Cost—Cents per Gallon | |
|---|---|---|
| | Small Refiner (5,000 b/d± Crude 300 b/d± Isomeriz.) | Large Refiner (30,000 b/d± Crude 1500 b/d± Isomeriz.) |
| Direct Cost | 1.0 | 0.3 |
| Direct Cost plus deprec. (at 20%) | 2.0 | 0.6 |
| Direct Cost plus deprec. plus Charge (@ 2c/gal.) | 4.0 | 2.6 |
| Direct Cost plus deprec. plus Charge (@ 4c/gal.) | 6.0 | 4.6 |
| Direct Cost plus deprec. plus Charge (@ 6c/gal.) | 8.0 | 6.6 |

TABLE 8—Summary of Costs for Pentane Isomerization

| | Isopentane Cost—Cents per Gallon | |
|---|---|---|
| | Small Refiner (5,000 b/d± Crude 200 b/d± Isomeriz.) | Large Refiner (30,000 b/d± Crude 1,000 b/d± Isomeriz.) |
| Direct Cost (Less small by-product credit) | 1.6 | 0.75 |
| Direct Cost plus deprec. (at 20%) | 2.6 | 1.15 |
| Direct Cost plus deprec. plus Charge (@ 2c/gal.) | 4.6 | 3.15 |
| Direct Cost plus deprec. plus Charge (@ 4c/gal.) | 6.6 | 5.15 |
| Direct Cost plus deprec. plus Charge (@ 6c/gal.) | 8.6 | 7.15 |

TABLE 9—Approximate Costs for Debutanized Catalytically Cracked Gasoline

| | Gasoline Cost—Cents per Gal. | |
|---|---|---|
| | Small Refiner | Large Refiner |
| Direct Cost | 1.1 | 0.6 |
| Direct Cost plus deprec. (at 20%) | 2.5 | 1.3 |
| Direct Cost plus deprec. plus Charge less by-product credits | 5.9 | 4.4 |

TABLE 10—Typical Calculated Costs of Butane-Free Polymer Gasoline

| | Polymer Cost—Cents per Gal. | |
|---|---|---|
| | 5000 b/d± Refiner | 30,000 b/d± Refiner |
| Direct Cost | 2.1 | 1.0 |
| Direct Cost plus deprec. | 3.6 | 1.8 |
| Direct Cost plus deprec. plus Charge (@ 2c/gal.) | 6.5 | 4.7 |
| Direct Cost plus deprec. plus Charge (@ 4c/gal.) | 9.4 | 7.6 |

catalytic cracking operations under recycle conditions usually produce $C_3$ and $C_4$ cuts rich in unsaturated hydrocarbons, and hence desirable as feed stock to polymerization or alkylation plants. Polymer gasoline (95 ASTM octane blending value) to the extent of 8-12% of the debutanized catalytic gasoline is recoverable by polymerization of $C_3$ and $C_4$ unsaturates. As an alternative, alkylation of these olefins can be practiced with considerations discussed in the section on "Alkylation" applying.

### Catalytic Polymerization

Although not in the category of a wartime process, a number of catalytic polymerization plants were converted to production of certain essential products during the war period, such as selective polymer and codimer (for ultimate hydrogenation and inclusion in aviation gasoline as hydrocodimer) and cumene. With the coming of peace, most of the 100 or more catalytic polymerization plants are reverting to their pre-war operation of non-selective polymerization of $C_3$ and $C_4$ olefins for motor gasoline production.

Since, as noted above, catalytic polymerization fits in well with most catalytic cracking operations a tabulation of typical calculated costs of butane-free polymer gasoline are presented in Table 10.

The above costs include cost of $H_2S$ removal from the charge stock. The charge cost is, of course, variable, depending upon particular refinery stock balances and product market prices.

With TEL credit for octane, (0.8-1.0c per gal. in typical blends) and with credit for additional butane which can be carried in the gasoline along with the polymer gasoline, polymerization can be considered an economical process, even for the small refiner, with 2c per gal. charge stock. With 3c per gal. charge stock, the polymer costs about 8.0c per gal. and the process becomes marginal in comparison with direct sale of the charge as, say, liquefied petroleum gas. Processes such as polyforming and gas reversion are also available for converting these fractions to motor gasoline by thermal means, usually in conjunction with naphtha reforming.

### Catalytic Reforming (Hydroforming)

Prior to the war, there were three hydroformer installations, and during the war five additional plants were placed in operation, primarily for the production of toluene. Because of the relatively small number of plants, each more or less of special design, it is difficult to make generalized economic statements regarding the process. However, the following figures are believed representative for a 5000 b/d plant processing low-sulfur virgin naphtha:

| | c/Gal. |
|---|---|
| Direct Cost of Hydroformed Gasoline | 1.0 |
| Direct Cost plus Depreciation (@ 20%) | 1.6 |
| Direct Cost plus Depreciation plus Charge ($2.10 per Bbl.) less by-product credits | 7.7 |

Considering 76 ASTM octane house-brand gasoline and 86 ASTM octane ethyl gasoline market prices as 6.0c per gal., and 7.0c per gal., respectively, indicates that the hydroforming process can be considered only as marginal with charge stock at 5c per gal. (account lead penalty). Certain conditions peculiar to an individual refiner such as low-value charge stock may alter this picture.

However, since the economics of the 5000 b/d installation are questionable, it is significant that at the present stage of process development, smaller units such as those associated with a 5000 b/d refinery would in all probability, be uneconomical. The basic concept of selectively altering the molecular structure of compounds present in gasoline with high yield is sound, and technological and economic advances can be expected.

### Summary

As an indication of the relative utility of the various war-time refining processes in peace-time operation, the following figures, drawn from the above discussion, are pertinent:

1. Assuming pre-war operations involved the production of gasoline from the 31° API L. A. Basin refining crude by distillation, reforming, and cracking, this gasoline might represent about 40% of the crude and consist of the following:

| | Vol. % |
|---|---|
| Light Straight-Run | 22.4 |
| Reformate | 26.2 |
| Cracked Gasoline | 46.6 |
| Butanes | 5.8 |

The above blend has a calculated clear ASTM octane of 71, and a lead susceptibility such that 79 octane is reached with 1.3 cc. TEL per gal.

2. Alkylation of all $C_3$ and $C_4$ olefins from reforming and cracking might increase the volume of the gasoline 25% (10% on crude) and increase the clear ASTM octane of the blend about 3.8 points. The incremental gasoline would cost 6.5-7.5c per gal. with 2c per gal. charge stock.

3. Pentane isomerization would not increase the gasoline yield but would raise the clear ASTM octane of the blend about 2.0 points. The isopentane would cost 7.0-8.4c per gal.

4. Catalytic cracking replacing thermal cracking at no increase in gasoline yield (conservative basis) would increase clear ASTM octane of the gasoline blend about 5.5 points. Designing for maximum yield by catalytic cracking might increase gasoline yield from the refinery 25% (10% on crude) and the clear ASTM octane of the gasoline blend about 6.5 points. The catalytic gasoline would cost 4.4-5.9c per gal.

5. Polymerization of $C_3$ and $C_4$ olefins

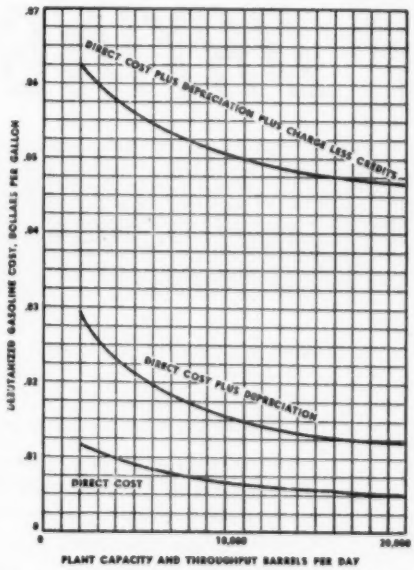



**Fig. 4—Typical catalytically cracked gasoline costs as a function of plant capacity. Basis: recycle cracking; gas oil charge, California wideboiling gas oil at $1.25 bbl.; butane product at $.02 gal.; dry gas ($C_2$ and lighter) at $0.13 MM BTU LHV; catalytic fuel oil at $0.90 bbl.; product recovery included**

might increase gasoline yield 10% (4% on crude) and increase the clear ASTM octane of the blend about 2.5 points. The polymer gasoline would cost 4.7-6.5c per gal. with 2c per gal. charge stock.

6. Catalytic reforming (Hydroforming) replacing thermal reforming might increase the gasoline yield about 5% (2.0% on crude) and raise the clear ASTM octane of the gasoline blend about 6.0 points. This gasoline would cost 7.7c per gal. or more.

### Conclusions

It should be again emphasized that it is not possible in a paper of this type to draw universally applicable conclusions, and that a process definitely uneconomical for one refiner may be economical for another because of fianancial, technological, or marketing features peculiar to him. The calculated costs presented to this paper are of necessity based on averaged factors for labor, maintenance, utilities, chemicals, and plant investment; plants designed specifically for individual applications may therefore show costs appreciably different from those presented herein. Furthermore technological advances will certainly improve the economics of all processes which are, by nature, of utility and hence maintained in operation and is a continuous state of development.

Based on the process reviews of this paper, and bearing in mind the above qualifications, the following general conclusions can be drawn with regard to the peace-time utility of war-time refining processes:

1. The most generally applicable refining tool commercialized during the war is catalytic cracking.

(a) It produces high yields of high octane gasoline (unattainable by thermal reforming or cracking) from low-valued stocks.

(b) It produces relatively high yields of $C_3$ and $C_4$ unsaturates which can be processed by alkylation or polymerization to supplement the yield of catalytic gasoline.

(c) While gasoline quality measured by ASTM octane is high, of greater significance is the wide spread between ASTM and Research octane (the latter running 8-12 points above ASTM). This is generally indicative of superior road performance of the fuel, which is the true measure of fuel quality[18] and which is destined to become a prime factor in competitive sales.

(d) Investment and operating costs for small units are not disproportionately high per unit of charge or product.

(e) In certain cases, existing thermal cracking furnaces and towers can be utilized, to minimize investment.

2. Thermal or catalytic polymerization of $C_3$ and $C_4$ unsaturates otherwise disposed of to fuel gas or low-priced liquefied petroleum gas is, as before the war, an economical operation for virtually all refiners conducting cracking operations.

3. Alkylation of $C_3$ and $C_4$ unsaturates and isobutane to the extent that they are available in excess of specification vapor pressure gasoline (and hence disposed of to low-priced fuel gas) is economical for large refiners and marginal for small refiners. Alkylation of materials such as pentenes charged in at adjusted gasoline values does not appear justifiable for motor gasoline production but may be economical in large scale operations for production of aviation fuel.

4. Isomerization of normal butane to isobutane for subsequent use in alkylation is justifiable economically only if field or refinery isobutane costs 1-2c per gal. more than normal butane, and alkylate produced therefrom is incremental and hence of low unit cost.

5. Isomerization of normal pentane to isopentane for octane improvement is economical only where suitable normal pentane charge can be easily segregated (as from straight-run gasoline) and in relatively large capacity units. This process, together with $C_7$ and $C_8$ isomerization appears potentially applicable to large natural gasoline plants, especially if they are operated in conjunction with crude oil refining facilities. Isomerization processes may be of value in the production of special aviation super-fuels.

6. Hydroforming, in the present stage of development, does not appear economically justifiable for up-grading octane of naphtha for motor fuel, but may be suitable for certain specialized operations such as aromatic chemical production.

The high moisture adsorption of low-cost Driocel is maintained indefinitely. It can be restored by thermal regeneration time after time to produce bone-dry gases or liquids. This cuts drying costs. Driocel is being used by refiners and chemists to dry:

**Feeds to alkylation and other catalytic processes.**
**Natural gas and pipeline gasoline.**
**Hydrocarbon gases, hydrogen, air, hydrogen sulfide, etc.**
**Liquid organic chemicals.**

Further applications of Driocel are constantly being developed Perhaps your own drying processes can be improved—or the cost reduced—by this activated bauxite desiccant. We'd be glad to talk it over. Just write Attapulgus Clay Company (Exclusive Sales Agent), 260 South Broad Street, Philadelphia 1, Pennsylvania.

**POROCEL CORPORATION** • **Bauxite Adsorbents and Catalysts**


#### References

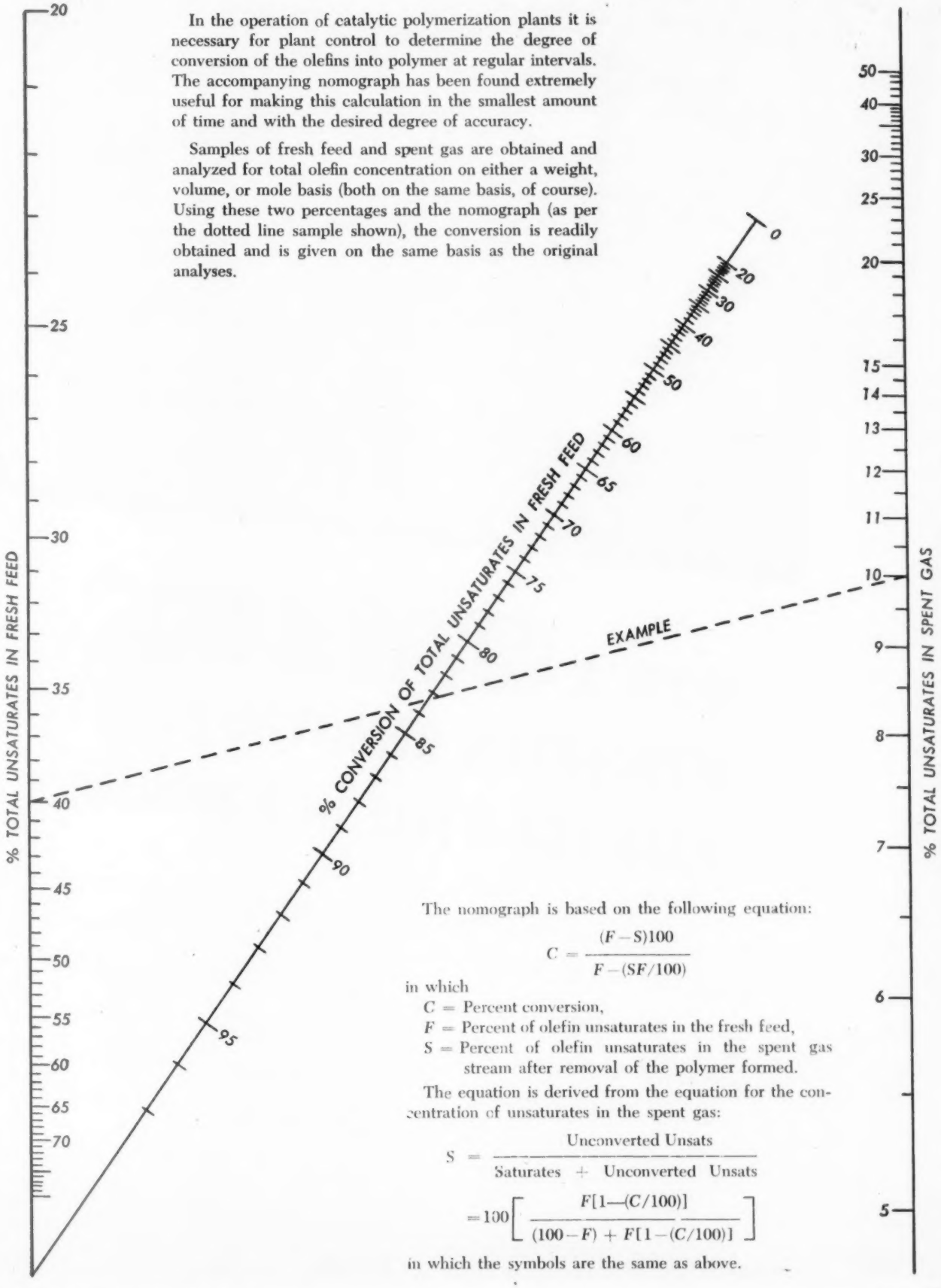

(1) Reinhardt; *O. and G. J.*, April 13, 1944, p. 133.
(2) Burrill; A.I.M.E., New York City, Feb. 20-24, 1944.
(3) Risk; *National Petroleum News, Technical Section;* 36, R 132-144, 1944.
(4) *National Petroleum News, Technical Section;* 37, Sept. 5, 1945.
(5) Newton and Shimp; *A.I.Ch.E.*, 41, 1945, p. 197.
(6) Newton, Dunham, and Simpson; *A.I.Ch.E.*, 41, 1945, p. 215.
(7) Murphree, Brown, Gohr, Jahnig, Martin, Tyson: *A.I.Ch.E.*, 41, 1945, p. 19.
(8) Buell and Waddill, *Refiner,* 23, Oct. 1944, p. 363.
(9-a) *Chem. and Met.*, June, 1945, p. 117.
(9-b) *O. and G.J.*, March 31, 1945, p. 183-185.
(10-a) Evering, Fragen, and Weems; *Refiner,* 23, Nov., 1944, p. 99.
(10-b) *O. and G. J.*, March 31, 1945, p. 196-198.
(11) Smith and Moore; *Chem. and Met.*, April, 1941, p. 77.
(12) Lake; *A.I.Ch.E.*, 41, 1945, p. 327.
(13) Parker and Ragatz; *National Petroleum News, Technical Section;* Feb. 2, 1944, p. R-68.
(14) *O. & G.J.*, March 31, 1945, p. 296.
(15) Mendius, *Refiner,* 24, June, 1945.
(16) Galstaun; *Chem. and Met.*, 52, Sept., 1945, p. 109.
(17) Noll and Bowles; *National Petroleum News, Technical Section;* Oct. 3, 1945, p. R-767.
(18) Jordan, *Refiner,* 24, Sept. 1945, p. 97.

# Nomograph for Calculation of Olefin Conversion in Catalytic 'Poly' Plant

By Elwood G. Glass, Jr.
Senior Engineer
Technical Service Division
Standard Oil Co. (Ohio)

In the operation of catalytic polymerization plants it is necessary for plant control to determine the degree of conversion of the olefins into polymer at regular intervals. The accompanying nomograph has been found extremely useful for making this calculation in the smallest amount of time and with the desired degree of accuracy.

Samples of fresh feed and spent gas are obtained and analyzed for total olefin concentration on either a weight, volume, or mole basis (both on the same basis, of course). Using these two percentages and the nomograph (as per the dotted line sample shown), the conversion is readily obtained and is given on the same basis as the original analyses.




The nomograph is based on the following equation:

$$C = \frac{(F - S)100}{F - (SF/100)}$$

in which

$C$ = Percent conversion,
$F$ = Percent of olefin unsaturates in the fresh feed,
$S$ = Percent of olefin unsaturates in the spent gas stream after removal of the polymer formed.

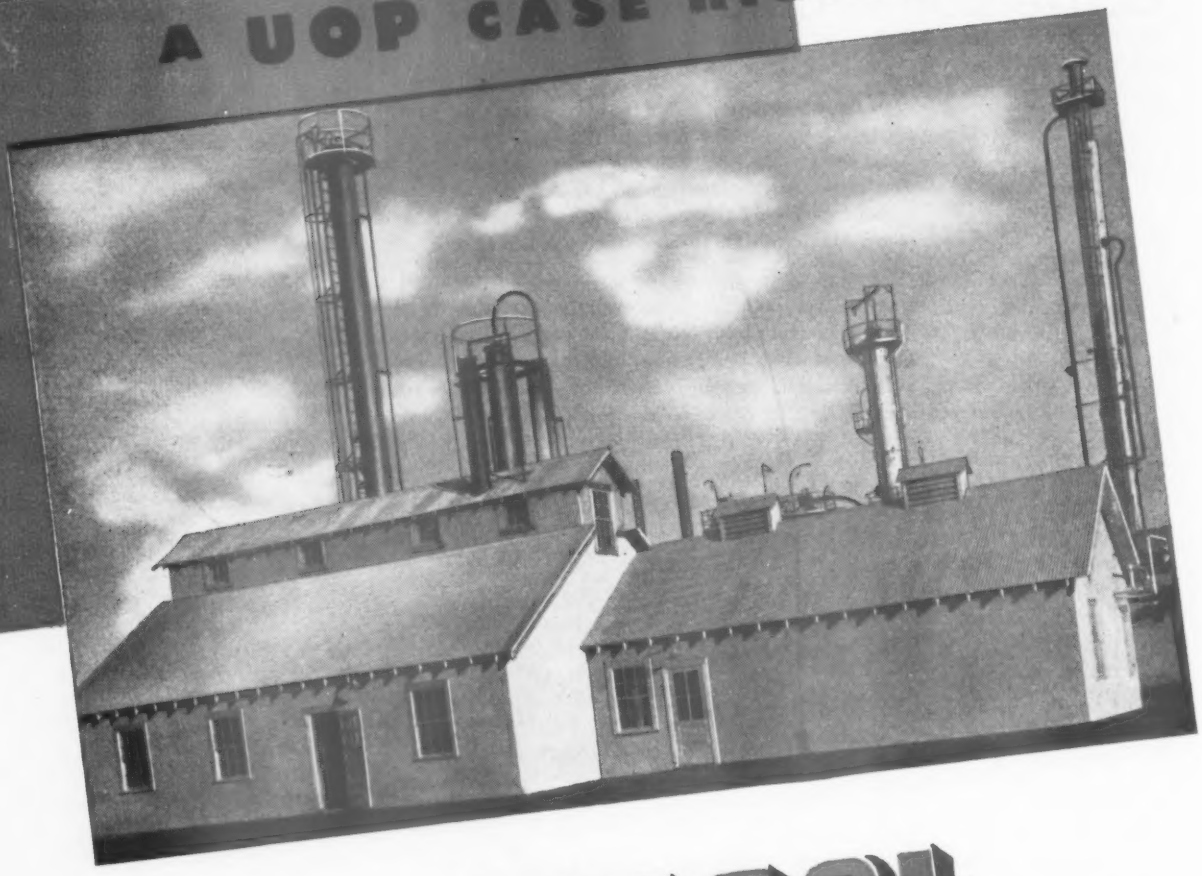
The equation is derived from the equation for the concentration of unsaturates in the spent gas:

$$S = \frac{\text{Unconverted Unsats}}{\text{Saturates} + \text{Unconverted Unsats}}$$

$$= 100\left[\frac{F[1-(C/100)]}{(100-F) + F[1-(C/100)]}\right]$$

in which the symbols are the same as above.

A UOP CASE HISTORY



# HOW A UNISOL MERCAPTAN REMOVAL PLANT PAID FOR ITSELF IN 8 MONTHS

The Unisol process was developed to extract mercaptans from gasoline instead of merely converting them. A careful study and analysis of results from five Unisol plants during the past three years shows that regardless of the nature of the gasoline or its degree of sourness, the removal of mercaptans is substantially complete. Furthermore, the cost is low, approximating 1¢ to 1½¢ per barrel for chemicals and utilities.

## Here, for example, is a brief resume of actual results obtained from one UNISOL plant

**1** Mercaptan content is reduced from 0.06—0.11% to an average of 0.0007% as it leaves the unit.

**2** Instead of a loss of 1 to 2 octane numbers by doctor sweetening, Unisol treating increases unleaded octane number by ½ point.

**3** A material reduction in total sulphur.

**4** A substantial increase in tetraethyl lead susceptibility.

**5** Prior to installation of the process, 80 octane gasoline could not be produced. With Unisol treatment, a 3 cc. addition of tetraethyl lead results in an 80 octane product

**6** Refiner can now blend all straight run gasoline with cracked product to produce house-brand gasoline.

**7** A severe treating loss was practically eliminated.

**8** Total cost of reagents is less than ½¢ per barrel of treated gasoline.

**Result,** initial pre-war cost of Unisol unit was amortized in 8 months.

This is a small 550 barrel per day plant. Greater economies result from larger installations.

*More complete details concerning this unit are contained in our booklet No. 255. Ask for your copy today.*

UNIVERSAL OIL PRODUCTS COMPANY

General Offices: 310 S. MICHIGAN AVE. CHICAGO 4, ILLINOIS, U. S. A.

LABORATORIES: RIVERSIDE, ILLINOIS

UNIVERSAL SERVICE PROTECTS YOUR REFINERY

# OIL SHALE RETORTING

## Principle of TCC Process Applied to Develop Continuous Operation in Which the Shale is Heated by Counter-Current Flow of Product Gas

*By J. W. Payne, C. H. Lechthaler and E. V. Bergstrom*

**Recognizing that present commercial scale shale retorting operations are cumbersome and costly, the experience gained in the TCC process was used to develop a method for retorting the shale continuously by gravity flow through a chamber in which the shale is heated by counter-current flow of the heated product gas. Advantages claimed are reduced retort investment and lower operating and maintenance costs.**

**Operations of a laboratory pilot plant retort are described and data presented on product yields and properties. A 100 ton/day pilot plant has been proposed to the U.S. Bureau of Mines for inclusion in its Synthetic Liquid Fuels program. It is emphasized that, for national security purposes, a commercial scale operation for obtaining oil from shale should be included in development work on this substitute fuel.**

THE POSSIBLE exhaustion of petroleum reserves in the U. S. and the necessity for national self-sufficiency in case of future emergency presents the continual problem of being prepared to utilize other sources of hydrocarbon oils. In recent years the petroleum industry has been actively investigating the production of such oils from natural gas, coal, and oil shale.

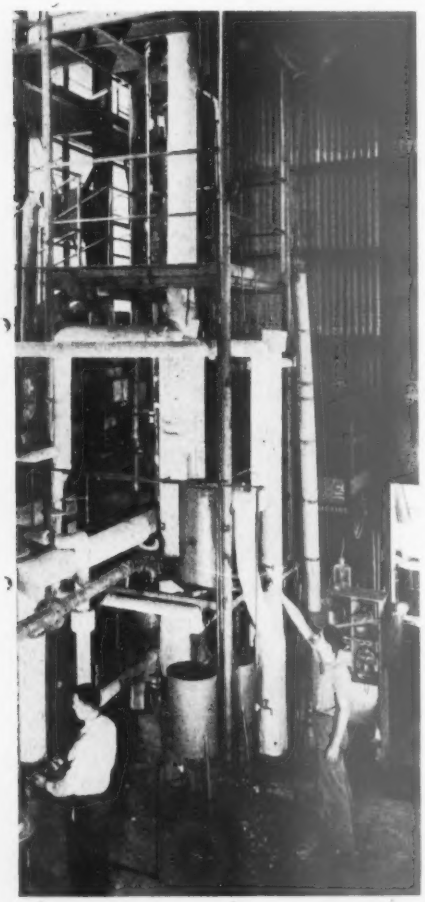


**Fig. 1—Laboratory pilot plant shale retort**

It is variously estimated that there is sufficient natural gas to synthesize oils equivalent to 5 to 10 years' supply of petroleum on the basis of present demands. Several concerns are working on the development of improved methods for natural gas conversion and pilot plant operations are well advanced. There is sufficient coal in the U. S. to supply equivalent petroleum demands for 1000 to 2000 years. Commercial processes are available for this purpose but development work continues. The conversion of either natural gas or coal into liquid hydrocarbons involves very high equipment investments for the synthesis of products which will meet probable quality requirements.

The other great potential natural oil reserve is oil shale. The workable deposits of oil shale in this country have been estimated to be in the order of 400 billion tons, containing the equivalent of about 90 billion barrels of oil corresponding to about 60 years supply. Oil shale does not contain oil as such but a solid bitumen type material known as kerogen which when heated breaks down into gases, petroleum-like liquids, and carbon[1].

Although shale oil is the most readily available substitute for petroleum, it does not appear economical at the present time to exploit this source. However, it is highly desirable for national security that a good method of obtaining the oil from shale should be developed through a full scale commercial operation of at least 10,000 bbls. of recovered oil per day. The cost for development of such a process in peacetime will be extremely small in comparison with that required if such work had to be done under emergency conditions resulting from another war.

The recovery of oil from shale involves mining, crushing, and retorting. The crude shale oil recovered by retorting is very poor in quality and requires additional refining to meet the requirements of petroleum products. The mining and crushing procedure is not far different from that currently employed in other commercial mining operations and with some additional development petroleum refining methods can be applied to processing the recovered crude shale oil into refined products.

However, commercial shale retorting operations are very cumbersome and expensive and are not considered satisfactory for the recovery of oil on a large scale. The commercial retorting methods currently employed in Australia, Scotland, and other countries having little or no crude petroleum resources, require enormous equipment installations for recovering very small quantities of crude shale oil. Previous methods of retorting oil shale have generally consisted of (1) vertical cast iron retorts through which lumps of shale pass by gravity and to which the heat is supplied through the retort walls, (2) rotary kiln type retorts, and (3) tunnel-kiln retorts in which the shale is loaded into small carts and passed through heated tunnels. All of these methods involve large equipment costs per unit of shale throughput.

Utilizing the experience gained in developing the TCC process, Socony-Vacuum engineers approached the problem with the idea of retorting the shale continuously by gravity flow through a chamber in which the shale is heated by the counter-current flow of heated gas. There are a number of factors which make this approach attractive. These include (1) inexpensive retorting equipment which consists essentially of a chamber with inlets and outlets for the shale and heating gas, (2) direct heat transfer from the heating gas to the crushed shale which gives a very high heat transfer rate, permitting high shale throughput rates per unit size of retort, and (3) prevention of agglomeration of the shale fragments in the retort by immediately sweeping the shale oil vapors from the retort by means of the heating gas.

In comparison with conventional retorting methods this retorting method is much more efficient and offers excellent

*Authors J. W. Payne and C. H. Lechthaler are with the Research & Development Laboratories, Socony-Vacuum Oil Co., Inc., Paulsboro, N. J.: E. V. Bergstrom is with the Refinery Engineering Division, Socony-Vacuum Oil Co., Inc., New York.*

**Fig. 2—Shale before and after retorting. Left, raw crushed shale; center, spent shale retorted in a stream of heating gases; right, spent shale retorted by external heating with no gas flow**

possibilities for reduced retort investment, operating and maintenance costs.

To investigate this technique a representative batch of oil shale was obtained from the enormous deposits near De-Beque, Col. This material assayed about 40 gal of oil per ton. It was crushed to 1/4 to 3/4 in. lumps and retorted in the laboratory pilot plant retort as described below.

The pilot plant retort consisted of a 6-in. diameter carbon steel pipe 10 ft. long which was wrapped with electrical resistance wire to provide the desired shell temperatures for maintaining adiabatic operating conditions. The raw crushed shale was fed to the top of the retort through a 3-in. diameter feed leg extending 10 ft. above the top of the retort to an open feed hopper. This is the smallest diameter pipe through which the crushed shale would flow.

The feed leg was equipped with a superheated steam inlet just above the top of the retort and the steam pressure was maintained slightly higher than the pressure at the top of the retort in order to prevent the loss of oil vapors through the leg. The feed leg was electrically heated to prevent excessive steam condensation in it.

The crushed shale flowed countercurrent to a stream of heating gases (usually steam) and was withdrawn intermittently from the bottom of the retort at 3 to 6-minute intervals. It was not feasible to maintain continuous flow because of the small size of the retorting unit. The heating gases entered the retort through a distributor ring 3 ft. from the bottom.

Low pressure steam (212°F.) was introduced just above the spent shale outlet to cool the spent shale as well as recover heat for the retorting zone. The gases and oil vapors were withdrawn from a disengaging zone at the top of the retort and condensed in a series of steam, water, and ice cooled surface type condensers. A small amount of fines carried into the condenser system with the gases and vapors was removed from the oil by centrifuging. Gas rates were determined by means of a dry gas meter connected to the outlet line from the ice-cooled condenser. The gas stream from the meter was continuously sampled after equilibrium operating conditions had been established. A photograph of this unit is shown in Fig. 1.

Operating conditions and product yields for a number of runs are shown in Table I. From the table it can be observed that for satisfactory yields of recovered oil a raw shale charge rate of about 250 lb./hr./sq.ft. is a maximum for the experimental retort (6 ft. length of retorting zone) when operating at 1000° F. However, for a commercial unit the shale throughput rates will be determined by the shale particle size and the maximum quantity of heating gases that can

**TABLE 1—Experimental Retorting Conditions and Product Yields in Recovering Oil from Shale**

| Method of Supplying Heat | Superheated Steam | Superheated Steam | Superheated Steam | Superheated Steam | Superheated Steam |
|---|---|---|---|---|---|
| Experimental Run No. | 19 | 20 | 22 | 23 | 30 |
| Operating Conditions | | | | | |
| Rates: Raw Shale | | | | | |
| Lbs./Hr. | 35.0 | 36.7 | 42.8 | 74.2 | 51.0 |
| Lbs./Hr./Sq. Ft. of Retort Cross Section | 175 | 183 | 214 | 370 | 254 |
| Residence Time in Retorting Zone, Min. | 117 | 112 | 96 | 56 | 81 |
| Superheated Steam, Lbs./Hr. | 29.5 | 31.4 | 35.6 | 46.7* | 47.9 |
| Cooling Steam, Lbs./Hr. | 16.5 | 17.0 | 21.3 | 20.0 | 26.0 |
| Temperatures: | | | | | |
| Vapor Above Bed, °F. | 592 | 615 | 581 | 512 | 565 |
| 14 In. Down Bed, °F. | 798 | 755 | 718 | 642 | 852 |
| Max. Retort Temp., °F. | 972 | 902 | 815 | 774 | 940 |
| Retorted Shale Discharge, °F. | 414 | 419 | 464 | 533 | 561 |
| Superheated Steam Inlet, °F. | 1010 | 908 | 818 | 803 | 1003 |
| Cooling Steam Inlet, °F. | 212 | 212 | 212 | 212 | 212 |
| Particle Size of Shale Charge, In. | ¼–¾ | ¼–¾ | ¼–¾ | ¼–¾ | ⅛–¾ |
| Yields, Based on Charge | | | | | |
| Retorted Shale, Wt. % | 74.7 | 78.2 | 76.9 | 85.7 | 75.4 |
| Oil—Wt. % | 15.8 | 14.2 | 13.9 | 6.5 | 13.2 |
| Gal./Ton of Shale | 40.7 | 36.6 | 35.9 | 16.8 | 33.6 |
| Retort Gas—Wt. % | 6.2 | 3.7 | 3.2 | 1.4 | 6.1 |
| Cu. Ft./Ton of Shale | 1560 | 955 | 785 | 330 | 1440 |
| Loss, Wt. % | 3.3 | 3.9 | 6.0 | 6.4 | 5.3 |

*Appreciably higher steam rates suspended the flow of shale.

**TABLE 2—Properties of Recovered Shale Oil**

| Method of Supplying Heat | Superh't'd Steam | Superh't'd Steam | Superh't'd Steam |
|---|---|---|---|
| Experimental Run No. | 19 | 20 | 22 |
| Properties of Shale Oil | | | |
| A.P.I. Gravity | 20.4 | 20.1 | 20.5 |
| A.S.T.M. Distillation, °F. | | | |
| I.B.P. | 257 | 201 | 270 |
| 5% | 375 | 372 | 391 |
| 10% | 451 | 452 | 462 |
| 20% | 558 | 566 | 564 |
| | Cracked at 24% —588°F. | Cracked at 20% —566°F. | Cracked at 20% —564°F. |
| Pour Point, °F. | 90 | 90 | 100 |
| KV at 100°F., Centistokes | ... | ... | 94.4 |
| KV at 210°F., Centistokes | 7.58 | 7.75 | 8.35 |
| SUV at 100°F., Sec. | ... | ... | 436 |
| SUV at 210° F., Sec. | 51.0 | 51.5 | 53.6 |
| Viscosity Index | ... | ... | 47 |
| Viscosity Gravity Constant | 0.881 | 0.884 | 0.878 |
| Sulfur, Wt. % | 0.73 | 0.68 | ... |
| Nitrogen, Wt. % | 2.16 | 1.81 | ... |

be put through the retort without suspending the flow of solid material.

The use of larger shale particles permits the use of greater amounts of heating gases, hence greater throughput rates per square foot of retort cross section. However, an increase in particle size will necessitate an increase in retort depth to provide the required residence time for heat transfer into the larger shale particles. For example, a plant retorting 10,000 tons of 1/2 to 1-1/2 in. shale per day would require retorts having a total cross sectional area of 2000 sq. ft., a bed depth of 20 ft., with an accompanying pressure drop of the heating gases through the retort zone of 25 in. of water.

A. Recovered Oil

Crude shale oil recovered from the retorting process is very waxy, highly unsaturated, and high in sulfur and nitrogen. The properties of the oil recovered were essentially the same for all of our operating conditions. These properties of the crude shale oil product from several experimental runs are shown in Table 2 and the yield and properties of the various fractions from a typical recovered oil are shown in Table 3.

B. Retort Gas

At a retorting temperature of 1000°F. the gas yield is about 1500 cu. ft. per ton of shale charged and at an 800°F. retorting temperature, is about 800 cu. ft. per ton. In both cases the retort gas has a heat of combustion of approximately 600 BTU per cu. ft. This gas consists primarily of a mixture of carbon dioxide and hydrogen with smaller amounts of hydrogen sulfide, nitrogen, carbon monoxide, and light hydrocarbon gases.

C. Spent Shale

The spent shale particles are of essentially the same size and shape as the charge, and although appreciably softer and more friable have sufficient strength to withstand the retorting operation. When completely retorted, the spent shale contains about 5% wt. of carbon and amounts to about 85% by volume of the crushed shale charge. Photographs of spent and raw shale are shown in Fig. 2.

TABLE 3—Properties of the Various Shale Oil Fractions

(Run No. 20)

| Distillation Products | Gasoline | Gas Oil | Bottoms |
|---|---|---|---|
| Yield—Vol. % of Still Charge | 13.7 | 46.0 | 40.3 |
| Properties of Fractions | | | |
| A.P.I. Gravity | 45.4 | 27.0 | 12.1 |
| A.S.T.M. Distillation, °F. | | | |
| I.B.P. | 189 | 456 | ... |
| 5% | 254 | 489 | ... |
| 10% | 270 | 509 | ... |
| 50% | 334 | 622 | ... |
| 90% | 438 | 692 | ... |
| E. P. | 504 | 716 | ... |
| % Rec. | 96.0 | 98.0 | ... |
| % Res. | 3.8 | 2.0 | ... |
| Aniline Number, °F. | 92 | ... | ... |
| Acid Heat, $H_2SO_4$, °F. | 126 | ... | ... |
| Sulfur, Wt. % | 1.0 | 0.58 | ... |
| Nitrogen, Wt. % | 0.76 | 1.4 | ... |
| Pour Point, °F. | ... | 45 | ... |
| KV at 100°F., Centistokes | ... | 8.65 | ... |
| Flash, P. M., °F. | ... | 220 | ... |
| Carbon Residue, Wt. % | ... | 0.1 | ... |
| B. S. & W., Wt. % | ... | Trace | ... |
| Bromine Number | 91.5 | ... | ... |
| Total Acid Absorption, Vol. % | 67.0 | ... | ... |

Fig. 3 shows the general arrangement of equipment proposed to the U. S. Bureau of Mines for retorting of oil shale on a 100 tons/day pilot plant scale. Raw shale is supplied from an elevator or conveyor to a storage hopper at the top of the retort vessel from which the shale flows downward by gravity to a preheat zone. The shale must be preheated to about 500°F. before entering the retorting zone in order to prevent condensation and refluxing of the shale oil on the incoming shale.

Furnace flue gas at about 1300°F. is blended with recycle flue gas and drawn through the preheat zone counter-currently at an inlet temperature of approximately 600°F. to furnish the heat required to raise the temperature of the shale to 500°F. At the latter temperature little or no combustible gas is evolved from the shale, and flue gas, therefore, provides a safe and efficient medium for supplying the necessary preheat.

From the preheat zone the shale passes downward through large pipes where it is purged of flue gas with superheated steam, the steam also providing a seal between the preheat and retort zones. Heat is provided to the retort zone by means of countercurrent circulation of hot process gas which is recycled at an inlet temperature of 1000°F. and provides the heat necessary to distill from the shale substantially all of the hydrocarbons. The shale in the retorting zone is maintained at a temperature of 1000°F. for a period of 60 to 160 minutes depending upon particle size.

The upper part of the retorting zone is utilized for heating the shale from the preheat temperature to the retorting temperature by extracting heat from the effluent vapors which are in turn cooled through about the same temperature range.

From the retort zone the shale, now spent, flows downward through steam purge pipes to a seal leg which serves also to conduct the spent shale to a chain grate stoker. The chain grate stoker serves the dual purpose of controlling the rate of shale flow through the retort, and supplying fuel to the tubular-type furnace which is used for heating recycle gas. The spent shale fuel at 1000°F. contains approximately 5% carbon of which a major portion can be readily burned with cold air supplied by a forced draft fan. Spent shale, substantially free of combustible carbon, is discharged from the end of the chain grate stoker at a temperature of 200-300°F. to a chute for

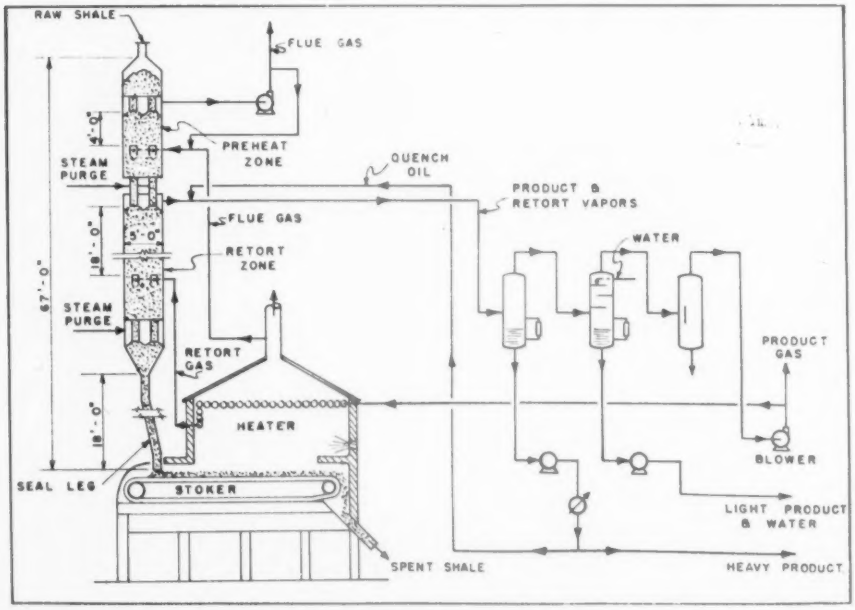



Fig. 3—Proposed 100 ton/day shale oil pilot plant retort

disposal. Gas burners are provided in the furnace to supply heat for starting up and for trimming.

It is proposed in the 100-ton pilot plant design to quench the product and recycle vapors from the retort zone with oil at 250°F. in order to avoid the use of surface condensers at this stage, as the probability exists that fines will carry over from the retort zone in sufficient quantity to foul surface condensers. The first stage condensing temperature of 250°F. was selected to enable condensation and withdrawal of a major portion of the product oil without condensing steam. Formation of emulsion between water and heavy oil is thereby avoided in this stage. Second stage condensing is done in a water spray tower to minimize pressure losses and avoid fouling of condensers. It is not certain that emulsion will be formed at this stage, but provisions for emulsion breaking may be necessary. Overhead gas from the second condenser is recycled as the retort heating medium.

A commercial installation capable of processing 10,000 tons/day of oil shale would consist of 10 to 15 retorts, each equipped with a stoker and tubular furnace. Retorts would be arranged to handle in groups the various sizes of shale produced by the crushing plant. A conventional steam and electric power plant would be installed utilizing the product gas from the retorts as fuel. A large shale crushing plant together with an extensive shale conveyor system would be required for supplying the crushing plant, the retorts, and for disposal of spent shale.

A mechanical problem requiring investigation on a pilot plant scale before a commercial plant is built involves the resilient property of oil shale with respect to crushability. Also, shale oil sulfur content is appreciable and consequently the extent of corrosion-resisting materials to be installed must be determined. The particle size to which the shale is crushed will indicate the arrangements and dimensions necessary to insure uniform solids flow.

The retorting section of the plant would be self-sustaining on a heat basis due to combustion of carbon on the spent shale. The product gas make would have a heat equivalent of 375,000,000 B.T.U. per hour and consequently, with a suitable steam-power cycle selection, sufficient energy appears available in the product gas to supply all steam and power requirements to make a shale oil recovery plant of the projected size completely self-sustaining. It is probable that by using this scheme of retorting the major cost of recovering substitutes for petroleum products will be in the mining of oil shale and refining the recovered oil rather than in the retorting operation.

(1) Kraemer, A. J. and Buchan, F. E., *Chem. and Eng. News*, Vol. 23, Page 1523, September 10, 1945.


# Five Processes that Profit by Hooker Anhydrous Aluminum Chloride

1. Alkylation or Condensation
2. Cracking
3. Refining
4. Polymerization
5. Isomerization

Here are five common applications of Hooker Aluminum Chloride as a catalyst in the petroleum field.

1. Alkylation or Condensation of paraffins with olefins to manufacture motor fuels; of aromatics with higher olefins or alkyl halides; to synthesize pour point depressants for lubricating oils.
2. Cracking of high-boiling hydrocarbons to manufacture gasoline.
3. Refining by decomposition of organic sulfur compounds by polymerization of gum forming constituents.
4. Polymerization of low-boiling hydrocarbons to manufacture motor fuels and lubricants.
5. Isomerization to manufacture branched paraffins of high anti-knock value, to effect ring closure of aliphatic hydrocarbons, to confer increased aromaticity.

If these processes are included in your operations or if you have any others where Aluminum Chloride is used as catalyst, it will pay you to use Hooker Anhydrous Aluminum Chloride. Uniform high purity of this Hooker Chemical accounts for its wide spread popularity in the petroleum field. For consistently dependable Anhydrous Aluminum Chloride, specify Hooker.

**PHYSICAL PROPERTIES**

**Aluminum Chloride, Anhydrous—$AlCl_3$**

| | |
|---|---|
| Molecular Wt. | 133.3 |
| Solubility, gms/100 gms solvent | |
| Nitrobenzene | 26.6 at 20°C |
| Orthonitrobenzene | 22.6 at 20°C |
| Heat of Solution | 550 small cal./gm. min. |
| Description | Gray, crystalline solid in three sizes |
| Analysis | |
| Aluminum Chloride | 99% Min. |
| Iron | 0.05% Max. |

HOOKER ELECTROCHEMICAL COMPANY
4713 Buffalo Ave.
NIAGARA FALLS, NEW YORK

New York, N. Y. Tacoma, Wash.
Wilmington, Calif.

HOOKER CHEMICALS

Caustic Soda Chlorine
Antimony Trichloride Muriatic Acid
Sodium Sulfhydrate Sulfur Dichloride
Sodium Sulfide Aluminum Chloride

8460

A BADGER-BUILT EDELEANU UNIT

# DECADES OF EXPERIENCE

in

PROCESSING

DESIGN

ENGINEERING

CONSTRUCTION

for the

PETROLEUM

PETRO-CHEMICAL

and

CHEMICAL INDUSTRIES

E. B. Badger & SONS CO. Est. 1841

BOSTON 14 · New York · San Francisco · London

# Careful Utilization of Non-Technical Personnel 'Stretches' Supply of Technical Workers

## Shortages of Skilled Technicians and Chemists in Oil Company Laboratories Are Being Overcome in Some Cases by Use of Non-Technical Workers for Routine Types of Work

*An NPN Technical Staff Survey*

**How several major oil companies use non-technical workers in their laboratories, what types of personnel are best suited, and how they are selected and trained are all described**

TECHNICAL manpower is being successfully "stretched" in some oil company research and development departments by the careful utilization of non-technically trained personnel for routine jobs. By this means shortages of such professional workers as chemists and chemical engineers are being overcome.

In most laboratories there has not been any "formalized" program for the training or utilization of non-technical personnel. Neither is there any standard list of qualifications or procurement procedure applying to this personnel. Yet hundreds of hours of the time of technical men have been saved for jobs they alone could do, time which otherwise would have been expended in setting up apparatus, recasting and recomputing data, redrawing graphical data, and performing other routine tasks—"pick-and-shovel work."

### Not Always Satisfactory

In some cases the use of technical clerks or assistants has not been satisfactory. One laboratory, for example, does not have sufficient work of a routine nature to permit use of non-chemists; its men must be free to jump from one job to another with perfect versatility. A man may be analyzing grease samples one day, doing research on corrosion inhibitors in gasoline the next and trouble-shooting on contamination in a plant gas-stream in between times. A non-technical person, unless exceptionally capable and experienced, is not prepared to handle such a wide variety of jobs.

The "test" division of this particular laboratory, however, for years has been staffed entirely with non-technically trained men, who run distillations, viscosities, gravities, vapor pressures, flash-and-fires, cloud-and-pour points and colors on the gamut of refined petroleum products. These men are trained on the job under the supervision of an experienced tester, and their work is double-checked until their data become reliable.

### Women Do Routine Testing

Women have been used in a number of laboratories for routine testing, a practice which increased greatly as the war continued. Some of them undoubtedly will be retained; others, working only while their husbands were in service, are returning to their homes.

Relatively few laboratories have been using high school and college students for "summer employment," but their attempts at utilizing them for regular part time jobs during the school term have proved unsuccessful.

Among the jobs which have been found suitable for the non-technically trained, according to several laboratories checked, were: routine testing, maintenance of such equipment as electronic and control instruments, knock-testing, pipefitting around a development and pilot plant laboratory and many types of routine analysis and low-temperature fractionation. Some, having oil-field experience, have proven particularly satisfactory as pilot-plant operators under a technician's supervision.

A number of workers with some college training, and several with degrees in a non-scientific field, have proven successful as computers. The main requirement here is possession of an analytical turn of mind and the ability to handle mathematics through, at least, algebra and trigonometry.

In a relatively few cases these people have risen to supervisory positions and, even without engineering, chemistry or physics backgrounds, have shown themselves capable of doing limited types of research.

### Must Have Math, Mechanical Ability

To a great extent, such technical assistants have had to demonstrate mechanical ability or background, and should be able to handle at least high school mathematics. A particularly good criterion, according to one laboratory director, is whether or not they liked high school chemistry and, to a lesser extent, physics.

Discharged veterans whose fighting jobs embraced the handling and maintenance of mechanical or communications equipment are considered especially good prospects for such jobs as knock-testing, pilot plant operation, maintenance and perhaps experimental fabrication of instruments. Some men are interested in and readily pick up the art of glass-blowing, using standard laboratory glassware and tubing to fabricate experimental equipment, although every laboratory is not equipped with the necessary facilities.

It has been found that age is not an important factor. Men and women of 50 have proven just as good—and bad—as younger persons. In general, older persons have more mature judgment and emotional stability, but otherwise the important qualifications have been the person's ability to learn and willingness to work.

An interesting sidelight, according to this source, is that non-technical personnel require long training before they can be taught the proper technique in handling an analytical balance. The general tendency is to treat one like the kitchen scales and to get confused with metric system weights. As a result, relatively few non-technical personnel have proven satisfactory on gravimetric analyses, although giving good results in analyses involving titrations.

### Start in Routine Laboratory

One research department starts its personnel in the routine laboratory. For the first week they study the A.S.T.M. manual of petroleum tests. Oral examinations are given by the supervisor-instructors. Then shift work commences, the "student" working with an experienced tester for break-in, and moving from job to job and shift to shift for about ten days.

After that he graduates into a shift job of his own, where he is under the supervision of an experienced tester for consultation at need. Generally if the new man is not able to handle his work by the end of three to four weeks, he is dropped. Progress and capability in part are judged by the amount of apparatus he breaks; if more than $100 worth is wrecked in the first two weeks it is considered doubtful that he will make good in a laboratory job.

Those in routine work showing particular aptitudes are selected for similar duties in research and development where, at all times, they work under direct technical supervision. They may assist in both construction and operation of pilot plants, in addition to the more common laboratory duties.

### "Technical Secretaries" Aid Supervisors

Another company makes use of two classes of helpers for their technical personnel: the non-technically trained for routine tests and "technical secretaries". Those in this latter group are classed as chemists. They relieve supervisors of such tasks as preparing certain letters, tabulating data and setting up filing systems on a rational basis. Frequently they can recast or redraw data in another form with but sketchy instructions from the supervisor. They do not type reports or

letters, however, but assist in their preparation. The technical secretaries generally are women who have had some college training — many have studied chemistry, physics and mathematics in teachers' colleges.

The entirely non-technical group preferably should have some mechanical background and must be able to handle high school mathematics, even though graduation from high school may be waived. For pilot plant work, knock-testing and the like, mechanical background and preferably oil-field experience is required.

### Service Men Prove Valuable

Still another laboratory, which has much the same division of personnel as that discussed above, requires high school graduation for routine testers. Men from the technical services of the armed forces have proven particularly valuable for mechanical jobs; their military training has developed familiarity with mechanical equipment, taught them to handle ordinary mathematics and developed their analytical abilities. Several of these men have shown research aptitude.

In their training, vocational classes were organized through the U. S. Office of Education. Government funds were used to pay the instructors, recruited from the ranks of laboratory supervisory personnel. The set-up was approved by USOE and in general followed procedures commonly used in high schools for teaching chemistry and physics.

This laboratory has used a few high school seniors for summer work. These were individual cases, however, and the boys had already shown aptitude along technical lines. The laboratory expects to continue this practice upon a limited basis, but candidates must convince interviewers they have the requisite ability and willingness to work.

### Technicians Do Individual Hiring

Of the companies surveyed, almost all indicated they did not recruit their laboratory help via conventional personnel channels. Personnel offices do help in many cases in referring individuals they believe might be of interest, but the task of hiring in large part has fallen upon the supervisory personnel. Some limit applicants to those more than 17 years old; still others generally consider only women and draft-exempt men, to reduce turnover.

One of several reasons for not using regular personnel channels, according to several research directors, is that transferring the class of people involved from one part of the country to another has resulted in dissatisfied workers. Another is that if the individual is willing to visit the laboratory personally, even if not in the same city with the personnel office, it is taken to indicate definite interest in such employment.

Returning veterans, such as former members of technical groups in Army or Navy service, are expected to be good bets for this type of work. A problem not too far afield from this is the "reorientation" of returning veterans who already were technically trained, but have been in a branch of the service which did not permit application of their technical skill.

Refresher courses which might be based on putting these men through some of the various jobs discussed previously to get them thinking in technical terms again, may help, but will not be the whole answer. One lab manager points out that it will take something more than a review to bring these men up to the degree of skill possessed before going into service and, more important still, to bring them up to date on what has happened during the war in the way of company operations and how these changes will apply in peacetime.

### Cooperation With Schools Planned

One company is now planning on attaining and keeping a much closer relationship with the colleges than heretofore. One of the things that may come, the research director believes, is an adaptation of the old trade-school idea in which the student spends parts of his time studying theory and the balance in industry, hitching theory to practice. While this may be more of a solution for future needs than for the problem of immediate requirements, the author believes "quickie" courses of this nature are worthy of consideration in veteran reorientation plans.

# Study of Tower Plate Hydraulics Made with Air and Water Tests

## Increased Efficiency of Single-Stage Atmospheric Crude Pipe Stills Is Obtained After Experiments Reveal Cause of Liquid By-Passing, Show How to Overcome Design Troubles

DIFFICULTIES in the operation of two single-stage atmospheric crude stills at the Bayway refinery of Standard Oil Co. of New Jersey led to a series of experiments which developed the cause of liquid by-passing and made possible changes which greatly improved the efficiency of the units. These studies were described in the paper "No Peace for Fractionators", presented before the recent meeting of the Refining Division of the American Petroleum Institute in Chicago.* The experimental setup is illustrated in the accompanying photographs.

The pipe stills (Fig. 1) were designed to each reduce 28,000 b/sd of East Texas crude to 20% bottoms, or 32,000 b/sd of West Texas crude to 30% bottoms, making a variety of well-fractionated products from a light naphtha overhead to a heavy gas oil bottom side stream.

The main towers, with sections of 12 ft., 6 ins. and 16 ft. 6 ins. in diameter, represented considerable extrapolation from previous high liquid load towers. The reflux and pumparound rates called for flows as high as 115,000 gph of hot liquid across the plates of the large towers. Gaps of 5 to 25° F. were expected, based on the 95% and 5% points of adjacent cuts.

Operation difficulties were encountered at less than design throughput. The fractionation was poor and trouble was

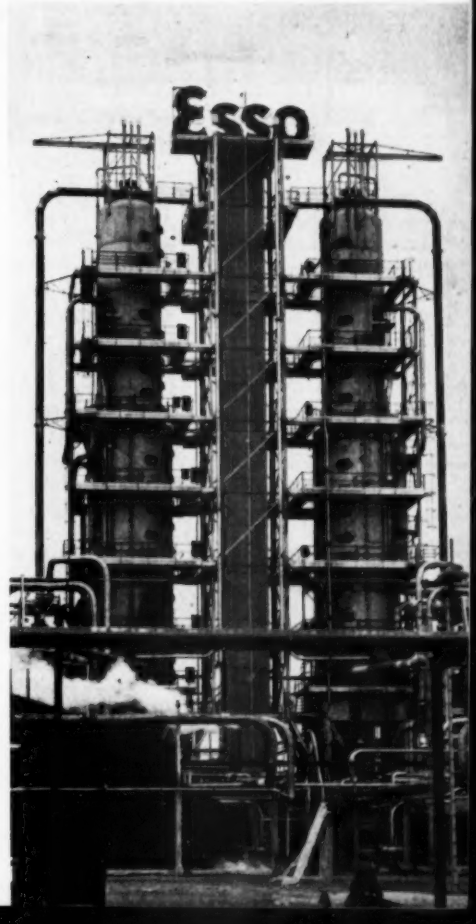



**Fig. 1—Bayway refinery atmospheric crude pipe stills**

*"No Peace for Fractionators", by P. J. Harrington, B. L. Bragg III, and C. O. Rhys, Jr., *NPN Technical Section*, Dec. 5, 1945, pg. R-965.

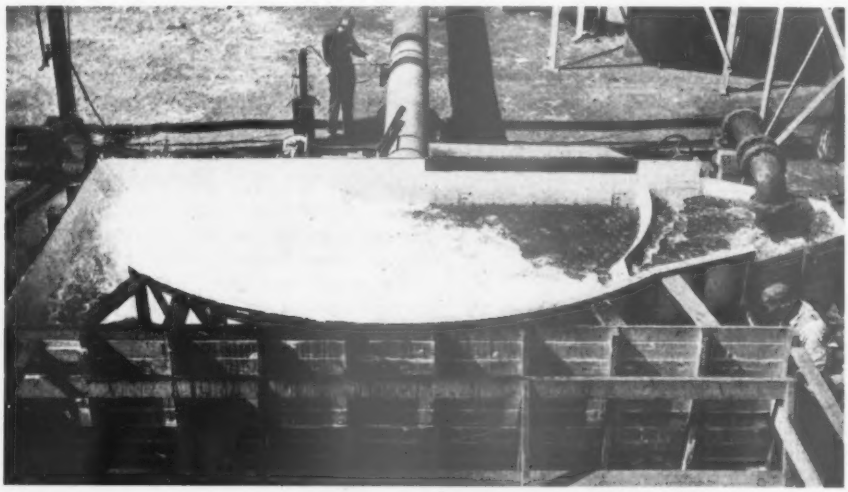


**Fig. 2—The air and water test bubble cap plate, showing poor vapor distribution resulting from excessive liquid gradient caused by high liquid flow rates. Flow of vapors has ceased on the liquid inlet side of the plate**

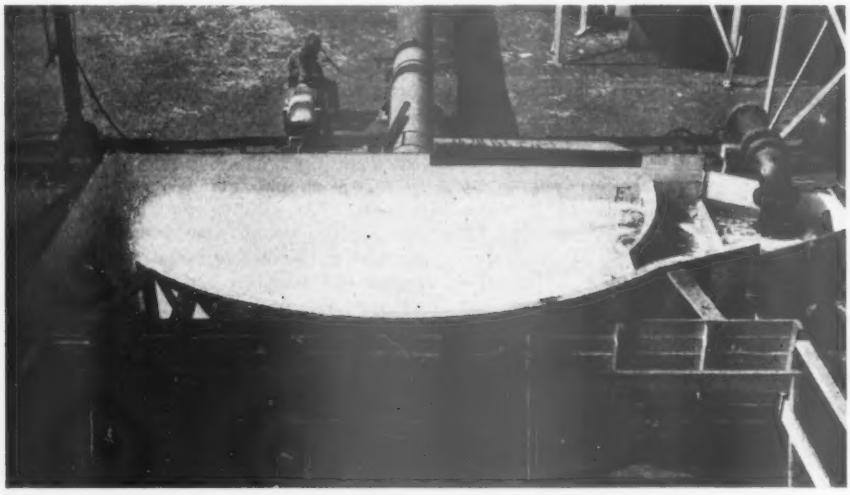


**Fig. 3—The air and water test bubble cap plate, showing good distribution of vapor and liquid across the plate**

encountered in withdrawing the refined oil side stream for product and a stream for cooling to induce reflux in the tower when returned as pumparound. After considerable study it was believed the main source of trouble was "dumping" due to plate liquid inlet side bell cap flow reversal.

In order to study the hydraulics of the tower plates, half of a spare plate was set up on a wooden box structure where air could be passed up through the section at varied rates while water was allowed to flow across it. An extensive program was carried out, from which it was possible to develop quantitatively what had happened in the large towers, and data for improving future design were obtained. Simple changes were made to the large tower plates by which it has been possible since to charge up to 45,000 b/sd of crude to the units obtaining gaps between 95% and 5% points ranging from 20 to 35° F. on contiguous cuts. Furnace capacity is the limitation to the present feed rate.

The difficulties in the operation of the Bayway pipe stills were described as follows in the paper referred to above* in the light of the studies with the air and water test bubble cap plate. (See Figs. 2 and 3.)

"With vapor passing up through all of the Bayway crude tower plate bubble caps, if the liquid flow across the plate is small, uniform and satisfactory operation results. As the liquid flow increases, the resistance due to the caps, to the vapor stream, and in the original tower, to the hold-down bars on the bubble cap rows (transverse to the liquid flow) establish a gradient which may eventually amount to from one to several inches of flowing liquid. In a 16-ft. tower, even this may be small. The average tower, however, has in the past contained as many caps as could conveniently be fitted in to improve vapor distribution and contact and these have been designed for minimum reasonable pressure drop.

"The drop through such caps may be from one to several inches of flowing liquid equivalent. Now, if the head on the liquid inlet side of the plate caps, due to an 'insignificant' liquid gradient, is greater than that on the liquid outlet side of the plate caps, and if this differential head is of the same order of magnitude as the small pressure drop through the caps, vapor flow will be reduced and finally stopped through the liquid inlet side caps as the liquid gradient increases.

"Note that overflow weir height, plate spacing, or average depth of liquid on the tray, do not, in themselves, affect this maldistribution of vapor flow. The important ratio is that of the plate liquid gradient to the cap pressure drop. At a given vapor loading, as more and more inlet side caps are blanked off by rising gradient as liquid flow increases, pressure drop through the fewer and fewer active vapor-loaded caps increases to tend to stabilize the tower operation. Since vapor loading normally increases with liquid loading (constant feed and product rates with increased heat input increasing vapor loading and reflux rate), a further stop to extreme blanketing usually exists.

### Brakes Not Always Effective

"Despite these brakes, if excessive liquid loading is built up, the head of liquid on the liquid inlet side plate caps will exceed the average plate cap pressure drop (even though this has increased as blanking takes place) and liquid will spill down through the inlet side caps to by-pass the plate and to affect adversely the fractionation. If a liquid sidestream product or pumparound draw-off is located at the outlet of a plate so bypassed, a very limited amount of draw-off is possible.

"It should be pointed out that the phenomena outlined differ from 'flooding' as usually defined where a tower 'pukes' or will not pass the liquid charged to it. A 'dumping' tower may give no external evidence of abnormal operation, especially if no large sidestream withdrawals are attempted. Many towers giving even tolerably good fractionation by the standards of experience for such towers may be 'dumping' and thus losing fractionation."


### Reprints

**Reprints of any articles appearing in the NPN TECHNICAL SECTION ordinarily are made only on order. Because present conditions prevent our holding the type after an issue is published, inquiries for quantity reprints should be forwarded promptly after receipt of the issue, by telegram if possible. Reprints ordered after the type has been broken down have to carry the additional cost of resetting the article.**

**Should you desire an article reprinted for you, please order the reprints promptly.**

# GASOLINE / GAS + COKE = CATALYTIC CRACKING EFFICIENCY

This simple equation illustrates one of the outstanding advantages of Houdry fixed-bed and T C C processes. Their yield of gasoline in ratio to fixed-gas and coke is the highest of all catalytic cracking processes. Other factors which favor Houdry-licensed processes are:

- low investment cost
- low operating cost
- high liquid recovery
- high quality and yield of gasoline
- stable products
- continuous engineering service

They all add up to greater profitability. Interested refiners, with a sharp eye on competitive trends, are invited to ask for detailed estimates.

**HOUDRY PROCESS CORPORATION**
WILMINGTON, DELAWARE

NEW YORK OFFICE: 115 BROADWAY, NEW YORK 6

*Houdry Catalytic Processes and the TCC Process are available through the following authorized firms:*

E. B. BADGER & SONS CO.
Boston, Massachusetts

THE LUMMUS COMPANY
New York City, New York

BECHTEL-McCONE CORP.
Los Angeles, Calif.

HOUDRY CATALYTIC PROCESSES
FOR VICTORY IN WAR
FOR PROGRESS IN PEACE

# Utilization of Natural Gas in the U. S.

*By G. G. Oberfell*

*Vice-President, Research and Development, Phillips Petroleum Co.*

**The future prospects of the use of natural gas for fuel purposes are bright and it is expected that, as more value is placed upon this commodity and transportation facilities are increased, less natural gas will be used in present low priced markets. Natural gas as a raw material in the manufacture of chemicals is of considerable economic importance, but the quantity used for producing chemicals will continue to be relatively small.**

**Natural gas is a more economic raw material than coal for conversion to liquid hydrocarbons by the Fischer-Tropsch process, and modifications of this process, using natural gas, will undoubtedly find useful applications, particularly where they can be combined with other processes or with existing facilities. The production of natural gasoline and the manufacture of chemicals afford opportunities for such combinations. As a means for producing gasoline alone, indications are the Fischer-Tropsch process would not be competitive with present refinery operations, using crude oil as raw material, under present prices.**

VARIOUS social, political and economic factors, in addition to such items as form utility and place value, investments in existing facilities, and future technical developments will exert their influences in varying amount on future gas utilization. Politically, subsidies and taxes could markedly influence the use of natural gas. The subsidies granted for distribution of electric power through the Rural Electrification Administration have not had a counterpart to date in natural gas or hydrocarbon fuel distribution. On the other hand, the taxes on motor fuel in some instances now exceed the selling price of the motor fuel at the refineries.

Through such taxation, it is possible to retard new developments or conversely through subsidies of one form or another it is possible to bring into being at an earlier date operations which would normally be considered uneconomical. For example, synthetic rubber was a war justification. In my opinion, the influence of government, through both subsidies and taxes, will be far greater than any other single factor on the future production, distribution and utilization of fuels.

Inasmuch as coal, petroleum, liquefied petroleum gas, and natural gas are in a sense different forms of carbon, it becomes obvious that, in many potential applications of these materials as fuel, the form value may markedly influence the economic justification for their use. These physical forms (solid, liquid and gaseous states) are important factors in determining the amount of investment necessary for production, transportation and utilization of these materials. Similarly, proximity to existing supplies of gas, oil or coal, especially when such fuels are available part of the time on an incremental cost basis, may result in uses based primarily on place utility. In such cases, comparative costs on a Btu basis alone may not be the decisive factor.

The importance of existing investments in producing, manufacturing and transportation facilities must be considered also. Underloaded gas transportation systems may be used to transport additional volumes of gas at very low costs since in such instances the only extra costs incurred are those for handling the additional volumes (the so-called incremental costs). In marketing of all types of fuel, intermittently available supplies can be sold at abnormally low rates, still realizing attractive profits.

Such underloaded facilities may be employed to handle additional quantities of fuel or raw material for the normally less attractive markets or they may be used to support a new development. For example, in specific cases processing facilities for natural gas and natural gasoline may enable one to lower overall costs of operation of a Fischer-Tropsch process for producing liquid fuel from natural gas. Likewise some war facilities may become useful in reducing investments for fuel distribution.

G. G. Oberfell

Faced with these important background factors, none of which can be ignored, the future possible outlets for natural gas constitute an interesting field for conjecture. Since the primary use of natural gas has been as a fuel, and since, in this application there has been and apparently will continue to be a steady and uninterrupted increase in the volumes so utilized, the most immediate prospect is one of domestic and industrial load building.

For the past ten years[4] the domestic natural gas load (home use) has shown a consistent increase. During this period this load has increased 87%. The increase in 1944 over 1943 was 9.4%. During the last year the increase in number of customers[5] was 2.8%. This greater percentage increase in gas load than in number of customers illustrates the generally accepted theory that natural gas is gaining in acceptance by its present users. One can immediately recognize the stability and strength of this load.

At the end of 1944 there were 8,578,000[5] domestic users of natural gas, the number having increased 16% since 1935.

An increasing domestic gas load can be expected as our population turns away from the many inconveniences and deficiencies of outmoded heating appliances. Expansion into the fields of gas-fired refrigeration, home freezers for quick-frozen food storage, space heating and water heating offer additional possibilities as domestic load builders. In some localities, even domestic air conditioning is now being commercialized. However, gas will have competition for the expanded domestic load, with the chief competitor in the fields of domestic refrigeration, cooking and water heating continuing to be electricity.

It can be expected also that the use of the complementary fuel, liquefied petroleum gas, will be greatly extended in the domestic field, primarily in suburban areas and in localities where gas distribution facilities are not available. It is also expected that the use of the coal and fuel oil for general house heating in well-designed and efficient equipment, operating with a new high standard of cleanliness, will show a decided increase and may ultimately arrest the trend toward the use of gas for this purpose.

The prospects for natural gas as an industrial fuel over the next several years

*The accompanying article is the principal portion of the paper "Utilization of Natural Gas in the United States," presented before the Chicago Section, American Institute of Mining and Metallurgical Engineers, Chicago, Dec. 5, 1945*

appear to be bright since we are undoubtedly entering a period of extreme industrial activity. However, from a more distant viewpoint, the extension of natural gas use does not appear probable in those applications where the cost per heat unit is the prime factor. Those industrial loads where uniformity of fuel and close control of heating operations are of more importance than the cost per heat unit will undoubtedly be retained by natural gas and liquefied petroleum gas, and some further extensions can be expected.

The production of carbon black from natural gas is, and probably will continue to be, a transient use for this raw material, confined mainly to the early life of gas fields and to those fields where pipe line outlets for fuel gas are inadequate. The present use of gas for carbon black manufacture may be expected to decrease gradually in favor of the more profitable fuel markets.

Of interest in this connection is the recent development on a commercial scale of an extremely flexible carbon black process which employs fuel oil and other liquid hydrocarbons as the starting material and which produces a much wider variety in quality of blacks than is possible by other well known processes. The success which the product of this process has met in various carbon black applications gives us reasonable assurance of a source of carbon black when gas no longer will be available for its production at prices that will enable its present wide use.

Much publicity has been given the postwar possibilities of chemicals, particularly the organic chemicals. Since the organic chemicals are "carbon chemicals," it follows that petroleum, natural gas, coal, agricultural and forest products are the primary raw materials. Extensive progress has already been made in the manufacture of chemicals from petroleum, and a substantial part of this progress has been accomplished by companies interested more in chemicals than in petroleum products. Strictly speaking, all compounds are chemicals, but the petroleum industry is rapidly beginning to think of chemicals as all of those new products from petroleum which are not used as fuels or lubricants.

As the principal products of the petroleum industry are fuels and lubricants, the majority of oil companies have, until recent years, directed their chemical research primarily to the manufacture of these products. Consequently, the majority of the new processes developed in the refining industry have been based to a steadily increasing degree on chemical reactions. Obviously the introduction of chemical knowledge in refinery technique will intensify the interest of refiners in the manufacture of chemicals. But more important than this is the abundance and variety of chemical raw materials resulting from the production and processing of oil and natural gas.

Furthermore, many of the hydrocarbon raw materials available in the petroleum industry are in effect by-products of the many processes which are used by the refining industry. For this reason they are ordinarily cheaper than raw materials from other sources. These facts are going to be important factors in the further development of chemicals from petroleum or natural gas.

In Fig. 1 is shown a skeleton diagram of the hydrocarbon family. The diagram presents the manner in which the chemist classifies the hydrocarbons and shows where they are found or produced.

In considering the manufacture of a chemical, the "conversion" state of the raw material to be used in the process is an important economical factor. All other things being equal, the less the number of steps through which the chemical raw materials must pass before emerging as a finished chemical product, the simpler and more economical will be the manufacturing process. An example of the manufacture of gasoline from coal will illustrate this point. Suppose we desire to make gasoline and we have two sources of raw material available; namely, coal and crude oil. Gasoline is a hydrocarbon liquid. If we manufacture gasoline from coal, we must first convert coal to a hydrocarbon liquid by a very complicated and very costly process known as hydrogena-

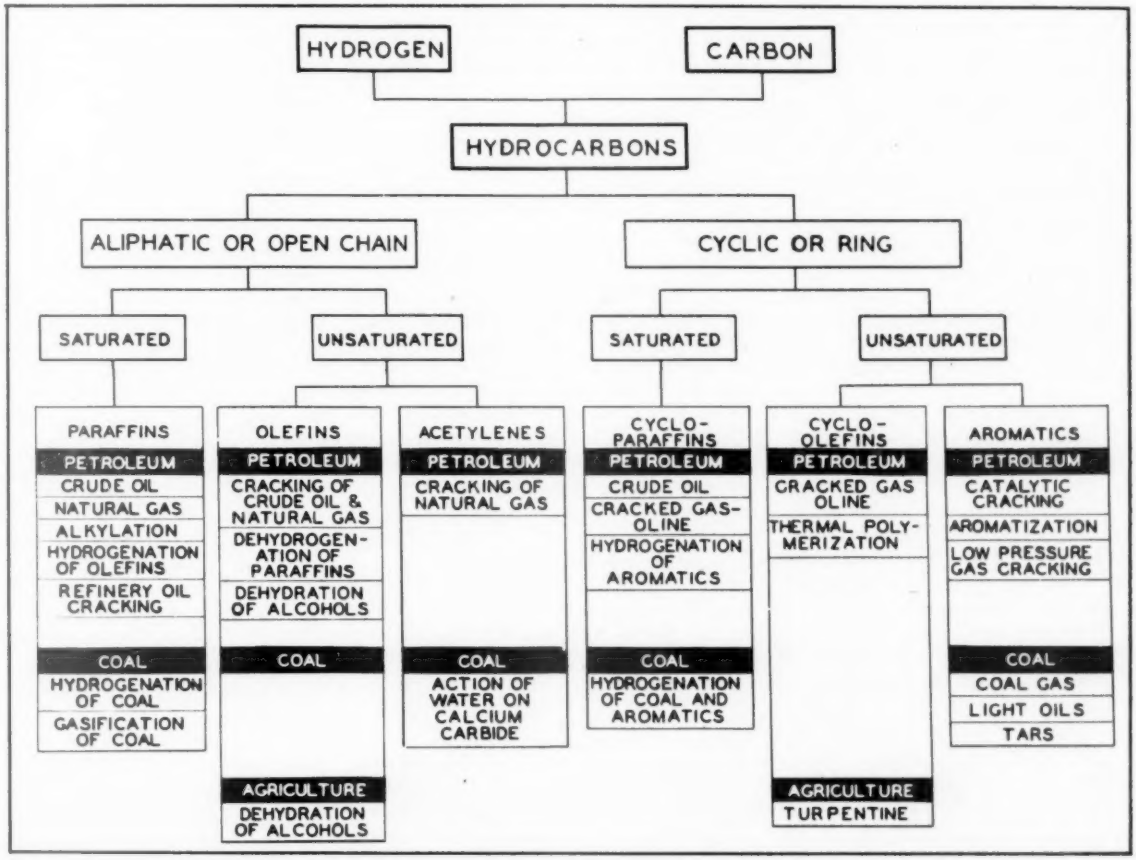



**Fig. 1 - Hydrocarbon classification and important sources**

tion, in which the cost of making hydrogen alone is a very important factor. After we make the liquid hydrocarbon mixture from coal by the costly process just mentioned, we must then do the same thing as is done with crude oil, that is separate it into the desirable and undesirable fraction and subject it to any further necessary processing.

Thus it is easily seen that petroleum as a source of gasoline, process-wise, is two steps ahead of coal, which must be converted into synthetic crude oil by two steps: first, that of manufacturing hydrogen, and second, that of hydrogenating the coal. A similar line of reasoning applies to natural gas as a preferred raw material, as compared with coal, for producing liquid fuel by the Fischer-Tropsch process.

The manufacture of chemicals from oil and natural gas is certain to increase, and the petroleum companies will undoubtedly place more and more emphasis on this activity. However, the manufacture of chemicals, as compared with the manufacture of fuels and lubricants, calls for a different type of operations, characterized in particular by small quantities, higher investments, higher costs, higher research budgets, a higher degree of technical skill, and a higher obsolescence of process and product; that is, shorter life of process and product.

Considering these differences, it is evident that the petroleum refiner may find it more expedient to manufacture intermediate raw materials for the chemical companies than to manufacture the finished chemicals. This is a procedure which is already being followed to a great extent. Many of the chemical companies have located their chemical plants adjacent to refineries on account of the cheap and abundant supply of by-product raw materials and on account of the widespread location of refineries throughout the U. S., which affords another economic advantage; namely, that of nearness of raw material to the markets for the finished chemical products. This is a trend which no doubt will continue until other economic factors change the picture.

With the exception of synthetic fuels used primarily in aviation gasoline, the largest recent interest in the chemical field has been in synthetic rubber. The production of this material in 1944 was about 750,000 tons. Other products now manufactured in appreciable volumes from petroleum and natural gas hydrocarbons include the familiar anti-freeze compounds, solvents, explosives, alcohols, and a veritable host of derivatives which constitute starting materials for many other products. The viewpoint of the chemists on these various developments is that the surface has barely been scratched and that further researches will bring quick results in the preparation of new and useful chemical derivatives from petroleum materials. The possibilities in the new field of synthetic plastics alone promise to make all the other petroleum chemical developments to date appear small by comparison.

Lest the impression be left that the chemical field is an unlimited one so far as market outlets for large volumes of raw materials are concerned, it is well to point out how relatively small such outlets generally are for these raw materials. Thus it was calculated recently that the entire 1944 production of wood alcohol could have been produced from a single gas well of 15 million cubic feet daily capacity, if near perfect conversion efficiencies were obtained. This means that the potential production, if realized, from only one of our larger gas wells would have completely supplied this whole market.

Similarly, if all of the ethane and ethylene present both in the gases at refineries and in the raw natural gases during 1944 had been converted to ethyl alcohol (generally called grain alcohol), the production of ethyl alcohol would have amounted to about eight times the total requirement estimated for 1944 and 40 times the amount of ethyl alcohol produced in 1940. If the entire potential supply of normal butane in 1944 had been used to produce butadiene for the manufacture of synthetic rubber, the amount of butadiene thereby manufactured, under present conversion efficiencies, would have been four times its demand.

Summarizing, it is interesting to note that the chemical uses today represent considerably less than one per cent of the total natural gas consumed, this volume being of about the same order of magnitude as the unavoidable losses occurring under the most efficient operations encountered in the best engineering and safety practices of the industry, using the most advanced technology. Thus the manufacture of chemicals does not promise to create any large volume of sales of natural gas.

Another possibility of a new outlet for natural gas is in the conversion of dry natural gas into liquid fuel hydrocarbons by means of the so-called Fischer-Tropsch process. The large mass of information which has been accumulated, as a result of research and development both here and abroad, permits a rough estimate of the process as a means of gas utilization. This process was developed in Germany where it was used mainly to synthesize liquid fuels, waxes and chemical raw materials from such available materials as brown coal, coke, low temperature coke and coke oven gas. Germany is reported to have produced 5,590,000[6] bbls of fuel annually by this process. The process comprises the following steps:

1. Conversion of the raw material to a water gas having a carbon monoxide to hydrogen ratio in the range of 1:1 to 1:2 and containing no more than 10 to 12% inerts.

2. Careful and thorough desulfurization of the gas, usually in two stages.

3. Synthesis of hydrocarbons by passing the gas through a fixed bed of catalyst, usually cobalt or iron, at pressures up to 100 to 150 psig (medium pressure process), and temperatures in the range of 400° F. This is a highly exothermic reaction (7,000 Btu per pound of liquid product).

4. Separation of the products, typical compositions of which are shown in Table 1.

As the hydrocarbons produced in the conventional Fischer-Tropsch process are principally of a straight chain-paraffinic nature, the antiknock quality of the gasoline is poor, but the cetane number of the diesel oil is high. The entire product can be handled readily in much the same manner as crude oil in conventional refining equipment to obtain products of desired specifications. Some catalysts yield a different type of product, richer in gasoline of high octane rating.

Although no commercial Fischer-Tropsch plants exist in this country, the U. S. Bureau of Mines did research on the process in 1928-1930 and resumed the work in 1944, primarily from the long-range viewpoint of utilization of solid fuels. In the last few years a tremendously increasing interest in the process has developed among oil and gas companies. This interest springs from the possibility of utilizing natural gas as a starting material. In this case, it is necessary to reform the natural gas by the well known hydrocarbon-water gas process, which is much cheaper and simpler than conversion of solid fuels

TABLE 1—Composition of Typical Fischer-Tropsch Products
(Weight Per Cent)

| | Atmos. Pressure Process, % | Medium Pressure Process, % |
|---|---|---|
| LPG | 13 | 7 |
| Gasoline | 52 | 38 |
| Diesel Oil | 26 | 30 |
| Wax | 9 | 25 |

TABLE 2—Efficiencies of Gasoline Production by Fischer-Tropsch Process[6]

| Raw Material | Raw Material to Produce One Bbl. Gasoline | Therms Necessary to Produce One Bbl. Gasoline | Therms Contained in One Bbl. Gasoline | Percentage of Fuel Value of Raw Material Converted to Gasoline |
|---|---|---|---|---|
| Coal | 1360 lbs. | 163.0 | 50.5 | 31.0 |
| Methane (European Design) | 505 lbs. (11950 cu. ft.) | 119.5 | 50.5 | 42.3 |
| Methane (Possible Future Design) | 440 lbs. (10450 cu. ft.) | 104 5 | 50.5 | 48.3 |

to water gas, in the first step outlined above. Combustion of methane with a proper ration of oxygen will also produce the synthetic gas. Subsequent steps are the same.

The yield of gasoline by the process when methane is used as the raw material is estimated at about four gallons per thousand cubic feet of gas. This gives us some indication of the approximate overall efficiency of the process as currently practiced, since the yield figure would imply that only about 40% of the heat content of the methane charged to the process would be recovered in the liquid product. In Table 2, a comparison of the yields from coal and from natural gas are given.

It is readily seen that the conversion of coal is less efficient than the conversion of natural gas. Further research, however, may improve the efficiencies.

From 1000 cu. ft. of methane, allowing none for fuel requirements, it is theoretically possible to obtain about 6.5 gal. of motor fuel. The fuel value of this 6.5 gal. of motor fuel would be about 75% of the fuel value of the original 1000 cu. ft. of methane. Therefore, the maximum fuel value recoverable is about 75%. In practice, however, even with 100% reaction efficiency as above, some methane will be required for fuel purposes. Consequently yields will always be less than 75% of the fuel value of the methane used to produce it. Improved reaction efficiencies, and, particularly improved techniques of synthesis gas production will no doubt reduce the amount of gas required with the result that net yields as high as 4.5 to 5.0 gal. per 1000 cu. ft. may be obtained in large scale operations.

For every cent of cost per M cubic feet of methane with 50% of the fuel value converted to gasoline, the raw material cost alone will be 0.25c per gal. of gasoline.

The competitive position of natural gas with respect to coal as a raw material for Fischer-Tropsch type processes in the U. S. will depend upon the relative economics, efficiencies of utilization and over-all reserves of coal and natural gas available. Table 3 shows conservative published estimates of the relative cost of producing gasoline using coal and natural gas as the starting material. Costs for gasoline manufactured from natural gas as low as 5c per gal. have appeared in the literature, based on 10% return on investment and assuming certain favorable local conditions.

At any rate, there is general agreement that gasoline from dry natural gas as a starting material is cheaper to produce than the same product from coal as the raw material. The raw material cost alone of coal per bbl. of gasoline would probably average somewhat greater than the cost of natural gas. For example, with natural gas at 5c per 1000 cu. ft., its cost per bbl. of gasoline produced (10,450 cu. ft. per barrel) is approximately $0.52.

To compare favorably with this cost, the price of coal per ton would have to be about $0.77 on the basis of 1360 lbs. of coal per barrel of gasoline produced. With natural gas at 10c per 1000 cu. ft. the equivalent price of coal would be $1.54 per ton. On the basis of conservative published estimates, the synthesis process utilizing natural gas will not be able to compete with present refinery methods utilizing crude petroleum until the price of crude reaches about $1.75 to $2.00 per barrel. On the basis of experimental data not yet confirmed by large scale commercial operations, gas may be competitive with crude oil under special circumstances.

Table 4 shows the potential gasoline which could be produced from proven reserves of oil, gas and coal assuming 50% yield from crude oil by conventional refining process and conversion of the natural gas and coal to gasoline by the Fischer-Tropsch process.

Although the conversion of natural gas may be important from the standpoint of augmenting raw materials for liquid fuel manufacture at costs not far from present costs, it cannot be considered an ultimate solution of the question. In short, the utilization of natural gas for hydrocarbon synthesis represents an "intermediate", but important, process and as such has greater immediate in-

**TABLE 3—Costs of Gasoline Production by Fischer-Tropsch Process[6]**

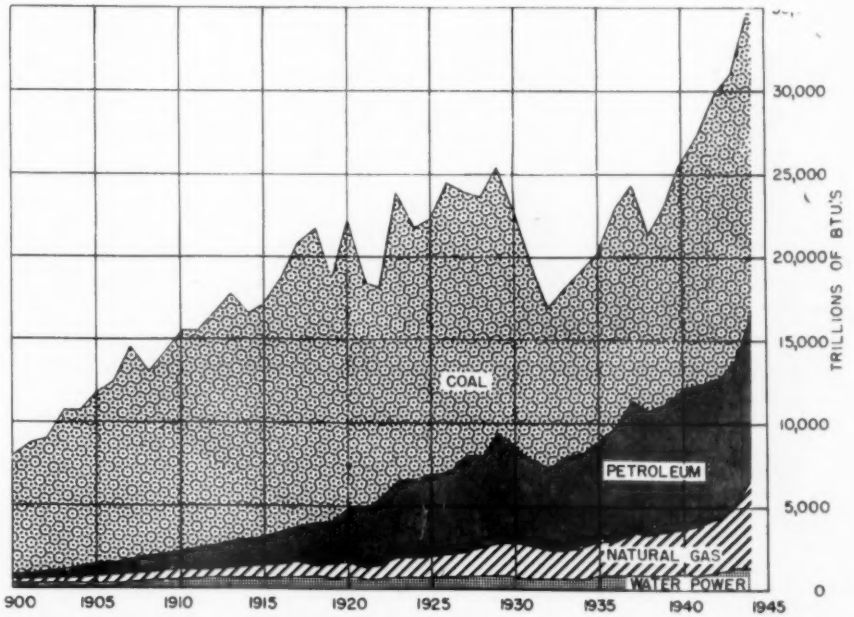
| | Investment Per Bbl. Motor Gasoline/day (Dollars) | Direct Costs, Including Normal Overhead but Excluding Depreciation, (c/gal) | Total Costs Including Normal Overhead and 10% Depreciation, (c/gal) |
|---|---|---|---|
| European Design, Starting from Coal | 7600 | 14.7† | 19.2 |
| European Design, Starting from Dry Natural Gas | 4750 | 6.0* | 8.8 |

†Coal at $2.75 per ton. *Natural gas at 5c/M.

**TABLE 4—Potential Gasoline Production from Crude Oil, Natural Gas and Coal Reserves**

| | Proven Reserves* | Estimated Gasoline Production (billion bbl.) | Years of Gasoline Supply At 1940 Rate of Consumption† |
|---|---|---|---|
| Crude Oil | 20 billion bbl. | 10.0‡ | 18 |
| Natural Gas | 140 trillion cu. ft. | 11.7§ | 21 |
| Coal: Most Suited for Fischer-Tropsch Process | 1.4 trillion tons | 2,100.0§ | 3750 |
| Coal: All Grades | 3.2 trillion tons | 2,100.0§ | 3750 |

*Data from Table 6.
† Assuming that the rate of gasoline consumption remains constant, unaffected by increased efficiencies, and assuming that the efficiencies of conversion of crude oil and natural gas to motor fuel is unchanged.
‡ Assume 50% gasoline yield.
§ By Fischer-Tropsch Process.




**Energy content of the minerals and water power used to supply annual demand in the U. S.**

terest than coal. Modifications of the Fischer-Tropsch process, using natural gas will undoubtedly find useful applications, particularly where the process can be combined with other processes or with existing facilities. The production of natural gasoline and the manufacture of chemicals afford opportunities for such combinations.

However, without the economic advantages of such combinations, the available information indicates that as a means of producing gasoline alone the Fischer-Tropsch process would not be competitive with present refinery operations, using crude oil as a raw material, under present prices. Moreover, the peak gasoline production from natural gas by the Fischer-Tropsch process will undoubtedly amount to only a minor proportion of the total gasoline supply of the nation. Our appraisal of the commercial possibilities of converting natural gas to liquid fuels on the basis of our own research and results reported by others, leads us to be more optimistic than is warranted by any conclusive published data.

The intense interest during recent years by several oil companies promises to crystallize in the near future the commercial development possibilities of the Fischer-Tropsch process for conversion of natural gas in the country. The success of this development would bring new problems of integrating it with the natural gasoline industry, with which it is complementary in that it affords an outlet for residue gas and for dry gas without a pipeline market, and with the natural gas fuel industry with which it promises to compete for that gas. Furthermore, the Fischer-Tropsch process has a very promising limited application to the synthesis of raw materials for synthetic lubricants, detergents, edible fats, solvents, aldehydes, alcohols, acids, etc., as practiced in Germany during the recent war.

From the standpoint of conservation, it should be pointed out that the larger heat loss inherent in the Fischer-Tropsch process of producing motor fuel is avoided by the direct use of natural gas as automotive fuel. Such use has received considerable attention in various foreign countries where liquid fuel supplies were inadequate. A comparison of equivalent cost of natural gas and gasoline for motor fuel is given in Table 5. The high pressure gas lines passing through the most densely populated areas of the U. S. afford a means of solving part of the economic handicap for the usage of natural gas as direct motor fuel. However, automotive vehicles using natural gas as direct motor fuel require considerable investment in tanks and fuel feed systems, as well as in other additional facilities. Furthermore, motor-driven vehicles are not often confined to local services in restricted areas but depend upon widespread availability of fuel. For these reasons, one can expect that the use of natural gas as a direct motor fuel will not be extensive.

### Fuel Reserves

In the preceding discussions we have assumed adequate reserves of natural gas. We will now give this subject of reserves further consideration. Louisiana, Texas, Oklahoma and Kansas are credited with some 83% of these reserves. The proven reserves of natural gas, petroleum and coal as of Jan. 1, 1945, are presented in Table 6 [4, 6] in terms of volumes, weights, and also on a thermal basis. Such reserve figures, it should be pointed out, do not take into account the effect of future advances in the science of exploration and the advantages to be gained through deeper drilling, nor to the possible opening up of new areas which will undoubtedly occur whenever the demand for new supplies becomes evident. The repeated forecasts made over the past 20 or 30 years indicating the early exhaustion of petroleum and natural gas deposits and the actual reserve history over this period are a good indication of how inaccurate such forecasts can be. In each instance, the new exploration activities, which resulted from a persistently increasing demand, effected an increase in the proven reserves which are now greater than at any time in the history of the industry. The fact that such additional reserves could be found while the industry was engaged in supplying a peak demand for gas and oil during the past world war period should give us some assurance that adequate supplies will be available for all of our needs for many years to come.

Any discussion of reserves, of necessity, must be based on various assumptions which may or may not appear reasonable. If we did not expect any new industrial developments and could consider our present fuel consumptions as constant, we could predict the expected life of petroleum and natural gas resources based on our past history. It has been frequently stated that our crude oil reserves will last only about 15 years at present rate of consumption. Using present crude oil production methods we recover less than one-third of the oil present in the reservoir; we convert less than one-half of that recovered oil into gasoline; and we translate considerably less than one-fourth of the energy of that gasoline into useful work. If we doubled the efficiencies of recovery of oil, doubled the yield of motor fuel manufacture, and finally doubled the efficiency of utilizing the fuel in the engine, we could make one barrel of oil reserves last as long as eight barrels of oil reserves at the present rate of consumption. If this were done, our present known reserves of oil would last not 15 years, as many have stated, but more than 100 years, as far as requirements of the internal combustion engine are concerned.

In my opinion there are more chances of research developing, within the next 100 years, entirely new sources of energy or using the available energy of present fuels in a radically different way, resulting in a surplus of crude oil, than there are that our petroleum resources will be exhausted in less than a century. The best an-

TABLE 5

Comparative Raw Material Values for Various Motor Fuel Manufacturing Costs

| Motor Fuel (Cents per Gal.) | Natural Gas to Make Gasoline Via Fischer-Tropsch* (Cents per M cu. ft.) | Crude Oil Via Present Refinery Method† (Dollars per Bbl.) | Natural Gas as a Direct Motor Fuel‡ (Cents per M cu. ft.) |
|---|---|---|---|
| 2.5 | —7.3 | 0.40 | 22.2 |
| 5.0 | 1.5 | 1.00 | 44.3 |
| 7.5 | 10.3 | 1.60 | 66.4 |
| 10.0 | 19.1 | 2.20 | 88.6 |
| 12.5 | 27.9 | 2.80 | 110.8 |
| 15.0 | 36.7 | 3.40 | 132.9 |

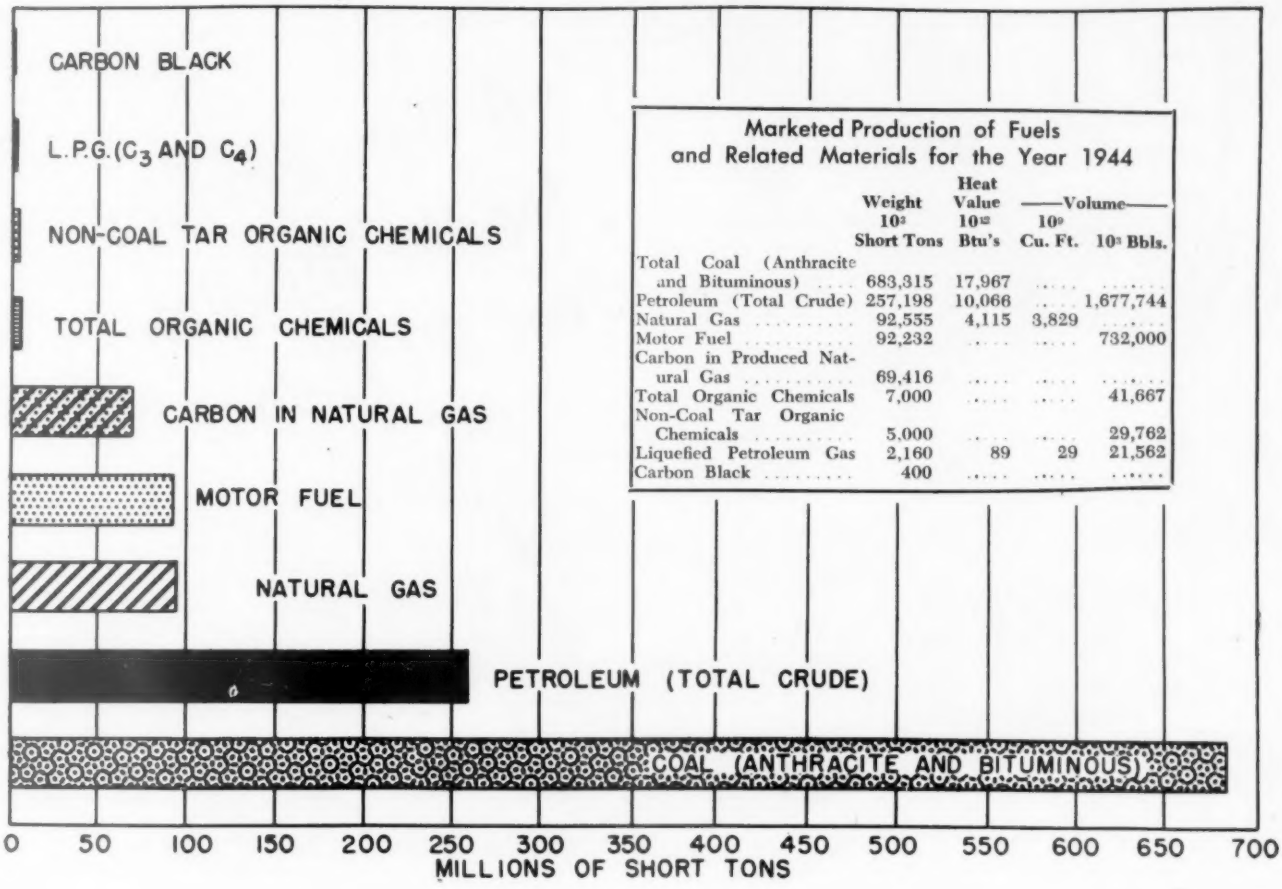
* Includes normal overhead but excludes depreciation. Derived from data given on pages 35 and 58 of "Synthetic Liquid Fuels" Hearing on Senate Bill No. 1243, Seventy-eighth Congress[5].
† Based on crude oil and gasoline price data from Minerals Yearbook[4].
‡ On an equivalent cost per Btu basis with motor fuel. Conversion factors[3].

TABLE 6

Proven Reserves of Natural Gas, Crude Oil and Coal as of Jan. 1, 1945

| | Weight (Thousands of Short Tons) | Heat-Value (Trillions of Btu.) | Volumes (Trillions cu. ft.) | Volumes (Millions of Barrels) |
|---|---|---|---|---|
| Natural Gas* | 3,384,500 | 150,000 | 140 | ..... |
| Crude Petroleum† | 3,135,000 | 123,000 | ..... | 20,453 |
| Coal (Suitable for Fischer-Tropsch)‡ | 1,400,000,000 | 36,400,000 | ..... | ..... |
| Coal (all grades)§ | 3,178,000,000 | 66,534,000 | ..... | ..... |

*Assume 1075 Btu. per cu. ft. and 48.35 lb. per M cu. ft.
†Assume 6,000,000 Btu. per barrel and 7.3 lb. per gallon.
‡ From Table 4.
§Corrected to an equivalent amount of coal, (2,559,000,000,000 tons) with a heating value of 13,000 Btu./lb.


CARBON BLACK
L.P.G.($C_3$ AND $C_4$)
NON-COAL TAR ORGANIC CHEMICALS
TOTAL ORGANIC CHEMICALS
CARBON IN NATURAL GAS
MOTOR FUEL
NATURAL GAS
PETROLEUM (TOTAL CRUDE)
COAL (ANTHRACITE AND BITUMINOUS)
0 50 100 150 200 250 300 350 400 450 500 550 600 650 700
MILLIONS OF SHORT TONS

Marketed Production of Fuels and Related Materials for the Year 1944

| | Weight $10^3$ Short Tons | Heat Value $10^{12}$ Btu's | Volume $10^9$ Cu. Ft. | Volume $10^3$ Bbls. |
|---|---|---|---|---|
| Total Coal (Anthracite and Bituminous) | 683,315 | 17,967 | ..... | ..... |
| Petroleum (Total Crude) | 257,198 | 10,066 | ..... | 1,677,744 |
| Natural Gas | 92,555 | 4,115 | 3,829 | ..... |
| Motor Fuel | 92,232 | ..... | ..... | 732,000 |
| Carbon in Produced Natural Gas | 69,416 | ..... | ..... | ..... |
| Total Organic Chemicals | 7,000 | ..... | ..... | 41,667 |
| Non-Coal Tar Organic Chemicals | 5,000 | ..... | ..... | 29,762 |
| Liquefied Petroleum Gas | 2,160 | 89 | 29 | 21,562 |
| Carbon Black | 400 | ..... | ..... | ..... |

swer to the problems of magnitude and longevity of petroleum reserves is to be found in higher prices for crude oil and gasoline which would not only result in the discovery of more crude oil reserves and promote the efficiency with which they are utilized, but would also enable coal to regain its lost markets.

If natural gas were used at the estimated 1944 rate of consumption our proven gas reserves would last a little over 35 years. Yet we know that a large amount of the gas used was sold at very low prices only because there was no higher price market available. Therefore, we can state quite assuredly that as higher price markets for natural gas are developed, or greater value is placed on this material, the low price markets such as carbon black, natural gas for power, and low price industrial uses will disappear. Such being the case, I am firmly of the opinion that our natural gas resources will not be exhausted prior to those of crude oil.

Although there are many source materials which could be used as petroleum substitutes, such as agricultural products, oil shale, tar sands and coal, there is yet no satisfactory substitute for petroleum in times of national emergency, due to the additional manpower and equipment that are necessary to utilize such substitutes during a national emergency. Petroleum is a convenient, high grade and valuable raw material which requires fewer operating steps, and less new facilities for converting it into other materials. For this reason, the intelligent use of petroleum resources in order that there may be adequate supplies for use in any national emergency, is essential in the national interest. The same is true of all our natural resources.

We do not know what may be the distant future quality of fuels and lubricants for the internal combustion engine. Carbon and hydrogen regardless of source are potential raw materials. We should continue to adequately investigate all sources, including agricultural products and coal. Some of the results of the large amount of research now being conducted by the petroleum industry will in future years find useful application in the conversion of coal and agricultural products to fuels and lubricants. Therefore, the research on petroleum and natural gas is supplementing and complementing the research financed by the government on agricultural products and coal. This latter research has been prompted by the desire to find new and replaceable resources of liquid fuels for the internal combustion engine.

The government research program in petroleum should be expanded since it is obvious that the result of such research will find earlier application and thereby serve to prolong the life of our petroleum reserves; and to such an extent serves the same purpose as research work on the conversion of agricultural products and coal which, by all means, should be continued. However, it may come as a surprise to some that for at least the next 20 years the petroleum and natural gas industries will in all probability be the primary beneficiary of any such research work on conversion of coal and agricultural products for the reason that these industries will undoubtedly be able to more economically utilize a greater portion of the results of such research in the manufacture of more and better fuels and lubricants.

#### References

(1) Data published by American Petroleum Institute.

(2) "Estimate of U. S. Gas Reserves", Statement of E. DeGolyer to Senate Committee on Investigation of Petroleum in Relation to the National Welfare, Washington, D. C.

(3) "Fuels of Today and Tomorrow", by Arno C. Fieldner, ASTM 40th Annual Meeting, Waldorf-Astoria Hotel, New York City, June 28, 1937.

(4) "Minerals Yearbook", U. S. Department of Interior, Bureau of Mines, 1937 to 1943, inclusive.

(5) Annual Statistics of the Natural Gas Utility Industry in 1944. AGA Statistical Bulletin No. 59, October 1945.

(6) "Synthetic Liquid Fuels", Hearings before a Subcommittee on Public Lands and Surveys, U. S. Senate, Seventy-Eighth Congress, First Session on S 1243, U. S. GPO, Washington, D. C. 1944.

# DU PONT FUEL OIL STABILIZER

VARIATIONS in refining methods, crudes, and in fractions available for distillate fuel oils contribute to the uncertainty of fuel oil stability. Guided by wide experience in the field of gasoline stabilization, plus knowledge of the requirements of fuel oil storage, Du Pont has developed a Fuel Oil Stabilizer. This new product is designed to help you eliminate costly treating methods. Investigate Du Pont Fuel Oil Stabilizer for improving stability of *your* oils in storage. Tests made with unstable fuels indicate the value of this new product in reducing oxidation and the catalytic effects of metals.

Outdoor storage testing of Du Pont Fuel Oil Stabilizer.

**Come to us** with your problems! Du Pont technical men, with many years of practical experience in the laboratory and in the field, will work with you in selecting or developing the *right* materials to meet your *specific* needs. For more details, write to: E. I. du Pont de Nemours & Co. (Inc.), Petroleum Chemicals Section, Wilmington 98, Delaware.

**CONSULT DU PONT ALSO FOR:**

*Gasoline stabilizers • Oil-soluble colors • Lubricating Oil additives • Fuel Oil additives • Metal Working compounds*

DU PONT
PETROLEUM
CHEMICALS

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

# Half of 34-Mile Pipeline Is Laid Under Water

ASSOCIATED with the construction last year of the Arabian American Oil Co.'s new refinery at Ras Tanura in Saudi Arabia* was the laying of a 12-inch 34-mile pipeline from the Dammam field to the Dahrein Petroleum company's refinery on Bahrein Island to meet its expanding requirements for Arabian crude. Seventeen miles of this line were laid under water across the Bay of Salwa between Saudi Arabia and Bahrein.

The pipe for the crossing was protected with Somastic pipe coating applied in the U. S. It was assembled in double lengths on the Saudi Arabian shore and hauled to a construction barge on which the line was welded.

Cathodic protection stations were also installed on each shore to drain a constant electric current from the pipe as a further safeguard against corrosion should the coating become damaged at any point.

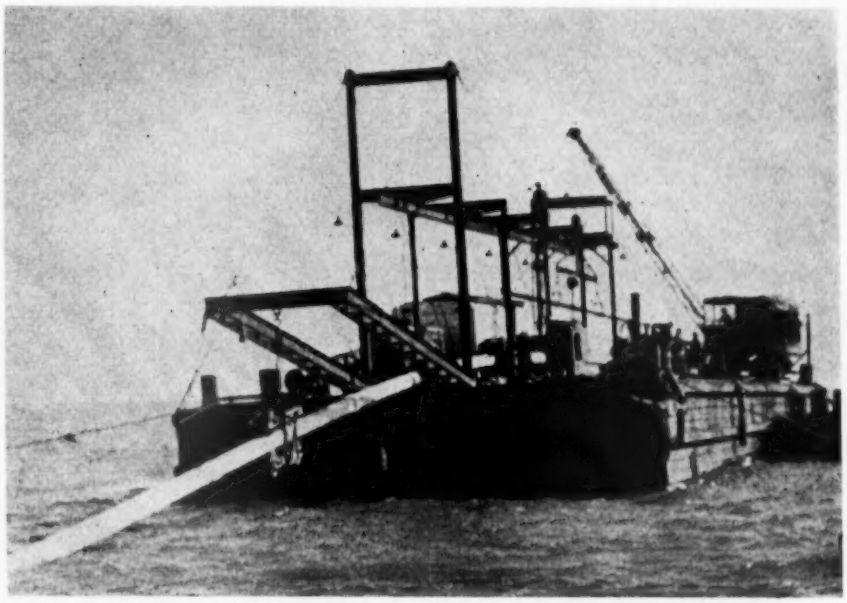
The first field operation for the submarine line was a complete hydrographic survey of the area between the island and the mainland. The best route for the line was selected and marked by driving a pile at intervals of 1100 feet, so that the pipe-laying barge could readily follow the course.

The piles were also used as anchors to secure cables with which the barge was held in place fore and aft or moved along by winches on the deck. Regular anchors to the bottom controlled the barge against lateral movement.

The construction barge, along with eight other smaller barges, was built, launched, and equipped at Ras Tanura. It is 180 feet long and 40 feet wide, has a narrow gauge railway down the center, an overhead monorail crane, electric light plant, radio station, running water, compressed air, welding machines, asphalt kettle, a large portable crane, powerful winches to handle the cables, and a cook house and messhall.

Lengths of pipe ferried to the barge were picked up by crane and placed on cars on the railway. Here they were welded together and the welds were covered with Somastic. The barge was moved ahead by pulling on the cables.

The pipe was fed from the stern over rubber-coated rollers which prevented damage to the coating. In deep water, a smaller barge followed and supported the pipe on more of the rubber rollers, suspended from outriggers on each side.



**ABOVE—A special barge, 180 feet long, was built to lay that portion of the pipeline which crossed the Bay of Salwa. The pipe was fed from the stern through rubber-covered rollers, which prevented damage to the pipe coating**

Storms and high seas caused interruptions. In one of the worst storms the side anchors gave way and allowed the barge to drift out of line enough to kink the pipe being laid. A diver with a hydrogen torch had to cut out the damaged section under 35 feet of water before the laying of the line could be resumed.

Night shifts under floodlights supplied by a Diesel-operated generator on the barge were begun late in December.

With all this, the actual elapsed construction time for the submarine portion of the line was 91 days, compared with the engineers' estimate of 90 days. The actual working days were 65. The worst storm of the season broke just 12 hours after the line was completed.

The last weld was made on Feb. 28. Then the line was given a 1200-lb. hydrostatic test, which it withstood perfectly. After connecting it to the tanks and pumps at Dammam Field, oil pumpings were started. The water in the line was displaced, oil reached Bahrein March 3, and the stream has been flowing continuously ever since, with no signs of leakage or other trouble.

**LEFT—Arabian natives did much of the work involved in laying the pipe, which was welded in double lengths on shore and then delivered to the barge. There the final welding and coating was completed before lowering the pipe into the water**

*An article describing the Ras Tanura refinery project in detail appeared in the NPN Technical Section for Aug. 1, 1945, pg. R-661.

# Only Five

Mechanism of Metric Reset Controller showing the simplicity of design. Operation is based upon the universally well-known Westcott orifice meter body.

## The New METRIC RESET CONTROLLER

# MAJOR SUB-ASSEMBLIES *all interchangeable*

Here is new simplicity and practicality in reset control instruments . . .

Just five major sub-assemblies. And all are interchangeable with other reset control instruments of our manufacture.

Reset control can be made reverse or direct-acting simply by reversing the position of two valves and two flappers (a one-minute operation). Reset can be made into throttling or vice versa by changing only two sub-assemblies.

Bulletin E-24 describes the instrument and its operation fully. It includes a cross-sectional drawing showing in colors the functioning of all parts. If you haven't yet received your copy, one will be sent you on request.

**AMERICAN METER COMPANY**
INCORPORATED (ESTABLISHED 1836)

Albany • Baltimore • Birmingham • Boston • Chicago
Dallas • Erie • Houston • Kansas City • Los Angeles • New York • Philadelphia • Pittsburgh • San Francisco • Tulsa

2310

# INDUSTRIAL LUBRICATION

*By W. G. Forbes*

## 9—Tests and Specifications (Cont.)

**W. G. Forbes, who had been contributing this regular feature to the *NPN Technical Section* since last May, was drowned last July. He was Lubricating Engineer for the Tide Water Associated Oil Co., New York**

**Before his death, however, Mr. Forbes had prepared a number of installments of his material in advance and submitted them to the editors. We will attempt to continue presenting his valuable contributions to the literature in the field of industrial lubricants and industrial lubrication as long as they are available.**

*Q—What is Viscosity Index?*

A—Viscosity Index (V.I.) is an arbitrary method of comparing the rate of change in viscosity with change in temperature, between different oils.

All mineral oils become thinner and less viscous as the temperature is raised. Conversely, they thicken and become more viscous as the temperature drops. But they vary in their rate of change. For example, oils made from paraffine base crudes exhibit less change in viscosity with change in temperature when compared with oils made from asphaltic bearing crudes. Hence, the unit of comparison is based on certain Pennsylvania reference oils which are given an arbitrary rating of 100 and certain Gulf Coast mineral oils which are rated 0. These reference oils are made from selected crudes and refined by specified methods.

In order to find the viscosity index of a mineral oil, the common practice is to use a set of prepared tables such as those published by the American Society for Testing Materials. With the aid of these tables one need only know two viscosity readings, one at 100° F. and the other at 210° F. to read off the Viscosity Index for that particular oil. The following are examples:

| Source of Crude | Viscosity (SUV) 100°F | Viscosity (SUV) 210°F | V.I. |
|---|---|---|---|
| Pennsylvania | 375 | 58 | 105 |
| Mid-Continent | 375 | 56 | 94 |
| East Texas | 375 | 54 | 78 |
| California | 375 | 52 | 57 |
| Gulf Coast | 375 | 50 | 28 |

Lubricants having a high viscosity index are desirable from several viewpoints. They are physically better adapted to high temperatures because they do not thin out as rapidly as low V. I. oils. Conversely, they are also better adapted to low temperatures because they do not thicken as rapidly. The following comparison illustrates this point:

| | Saybolt Viscosity Seconds at | | | | |
|---|---|---|---|---|---|
| VI | 250°F | 130°F | 100°F | 32°F | 0°F |
| 103 | 42 | 128 | 250 | 2,800 | 16,000 |
| 18 | 38.5 | 115 | 250 | 5,000 | 50,000 |

Notice that both oils have a common viscosity of 250 sec. at 100° F. However, at a temperature of 0° F. the low viscosity index oil would take about 50,000 sec. to run out of the Saybolt instrument while the high viscosity index oil would only take 16,000 sec., or about 14 hrs. for the low V.I. oil against 4½ hrs. for the high V.I. oil. Thus, the difference in flowing ability at low temperature is considerable and there would be quite a difference in cranking energy required for a gasoline engine making a cold start with the low V.I. oil in the crankcase.

These comparisons are of interest in connection with S.A.E. numbers for motor oils. While both oils have the same viscosity at 100° F. the high V.I. oil would fall in the S.A.E. 20 rating at 130° F. and the low V.I. would fall in the S.A.E. 10 rating at 130° F., yet the oil of low V.I. and S.A.E. 10 rating would actually be much more viscous at low temperatures. This apparent discrepancy is brought about by the fact that S.A.E. numbers do not take into consideration the viscosity index of an oil.

The ratings of 10W and 20W are not actually S.A.E. ratings but a 10W rating calls for a minimum Saybolt viscosity of 5,000 sec. at 0° F. and a maximum of 10-000 sec. Hence, neither oil would qualify in the 10W rating.

The rating of 20W calls for a minimum Saybolt viscosity of 10,000 sec. at 0° F. and a maximum of 40,000 sec. Hence the low V.I. oil of S.A.E. 10 rating would barely qualify as a 20W oil. The high V.I. would qualify in both the S.A.E. 20 and 20W rating.

This discussion may seem a little involved but the whole point is based on the fact that when approximate conversions are made to S.A.E. numbers from readings taken at 100° F. and 210° F. the viscosity index of the oil may influence the S.A.E. number, particularly the unofficial but often important 10W and 20W ratings. When operating outdoor equipment in very cold climates, these matters require more than a superficial investigation. They have a direct influence on performance and require careful consideration.

For example, the 20W rating calls for a maximum Saybolt viscosity of 40,000 sec at 0° F. because this is about the limit for starting an automotive engine at low temperatures without the aid of an auxiliary heater or without diluting the crankcase oil with some gasoline. The viscosity of the oil at higher temperatures is not taken into consideration. Only cold starting conditions are considered in the 10W and 20W ratings.

Many attempts have been made to classify lubricating oils by taking into consideration (1) Saybolt viscosity limits and (2) Viscosity Index limits but the variables involved have prevented an acceptable solution.

However, the low temperature motor oils are very often marked S.A.E. 10 and 10W, or S.A.E. 20 and 20W, to show that they meet two viscosity limits, one at 130° F. and the other at 0° F. In order to meet both requirements, they must have a fairly high Viscosity Index rating.

*Q—What is meant by the Flash and Fire Point of a Lubricating Oil?*

A—The flash point of a lubricating oil is the temperature to which it must be heated to give off sufficient vapor to form an inflammable mixture with air. When a pilot flame is applied the vapor burns and then goes out for want of more vapor.

The fire point is the temperature to which the oil must be heated in order to burn continuously after the mixture of air and vapor has been ignited. This condition takes place after continued heating has raised the temperature of mineral oils about 50 to 75° F. above the flash point.

Lubricating oils are tested for flash and fire in a simple open cup known as the Cleveland Open Cup Tester. Flash point tests are generally employed to indicate the element of fire hazard, but when applied to lubricating oils the information generally guarantees against dilution with lighter and more volatile fractions, or it may have significance if the oil is going to be subjected to high temperatures, as for example, in hot oil circulating systems where heavy, viscous oils are often used to heat other substances to temperatures as high as 600° F.

As a general rule, the flash and fire points of paraffine base oil runs higher than mixed base and naphthenic types.

The following are average open cup Flash Points for petroleum products:

| | |
|---|---|
| Gasoline | Below 0°F |
| Cleaning Naphtha | 110 to 115°F |
| Kerosene | 115 to 150°F |
| Light Mineral Oils | 325 to 400°F |
| Heavy Mineral Oils | 400 to 500°F |
| Cylinder Stocks | 500 to 625°F |

The flash point of a petroleum product varies with the apparatus employed to make the test. For this reason it is necessary to specify the apparatus.

# SECURING and PRESENTING FOUNDATION DESIGN DATA

**By Trent R. Dames**

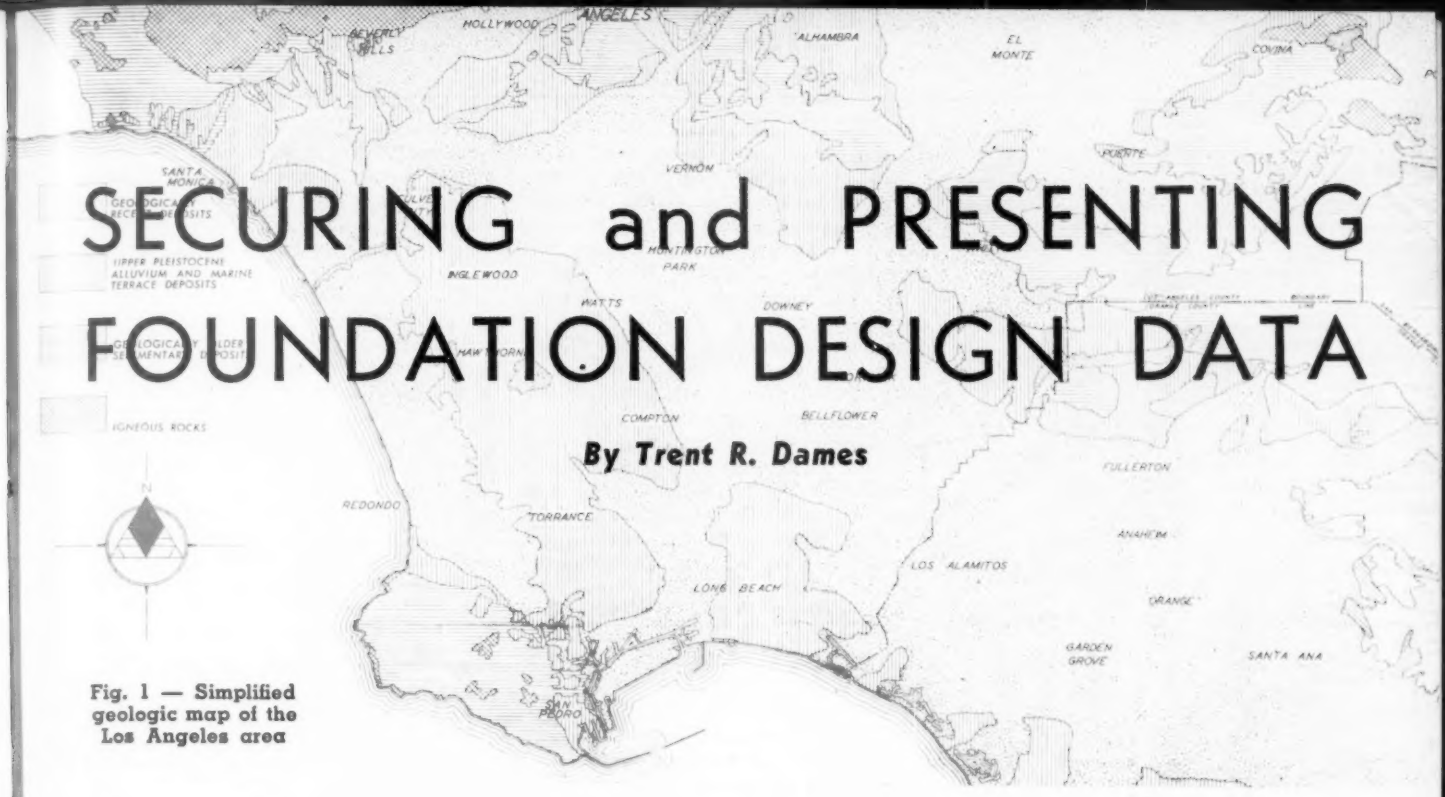



**Fig. 1 — Simplified geologic map of the Los Angeles area**

The art of securing and using foundation design data has received its greatest impetus from the new science of soil mechanics, which has experienced its principal development during the last 25 years. Soil mechanics has been defined as follows by Karl Terzaghi, under whose direction most of the early research in this field was carried out:

"The application of the laws of mechanics and hydraulics to engineering problems dealing with sediments and other unconsolidated accumulations of solid particles produced by the mechanical and chemical disintegration of rocks, regardless of whether or not they contain an admixture of organic constituents".

In a field of such great breadth, it is necessary to limit any specific discussion to some small phase of the subject. I have chosen as my topic "Securing and Presenting Foundation Design Data".

Before going into detail, I would like to briefly outline some of the important phases of soil mechanics in order to illustrate its scope. Soil mechanics deals with what the geologist calls "mantle" or "regolith", but which to the civil engineer is commonly known as soil or earth. The field of soil mechanics is one which is rapidly changing as the scope of our knowledge increases. New research is continually being reported and is continually modifying the practical applications of this science to engineering problems.

As in all new fields, the questions which cannot be answered far exceed in number those which can be answered, and most of the latter can be answered only imperfectly. However, development of the science has advanced to the point where it is very considerable aid in the solution of certain critical engineering problems, among which are the following:

**The importance of the studies of soils on proposed refinery and other industrial sites is recognized as a necessary preliminary to the proper design of foundations. Various means for making such studies are available. Maps, aerial photographs, logs of wells in the vicinity and other data are useful. In most cases borings are necessary, however, to determine with sufficient accuracy the foundation conditions on the selected site. Field load tests and new laboratory procedures are used for measuring the shearing strength, compressibility and other properties of foundation soils.**

(1) Investigations of the character of the foundation soils present on the site of a prospective development for the purpose of:

(a) Evaluating the costs of developing a potential industrial or commercial property;

(b) Planning the development of a selected property in order to enable the arrangement of structure so as to take advantage of varying foundation conditions;

(c) Determining, after the site and plant arrangement have been selected, the types of foundation best suited for the support of the proposed structures;

(d) Determining specific design values for particular foundations so that safe and economical foundations for the support of a particular structure on a particular site may be obtained.

(2) Analyses of conditions which have led to objectionable settlements of existing structures, and a feasible means of correction;

(3) Analyses of the stability of earth embankments, excavations, etc., and of the lateral forces on retaining walls, quay walls, and so on;

(4) Investigations of the materials available for the construction of all types of earthfill structures, the methods of placing these materials to the required quality, and the design of these structures to resist the loads that will be imposed upon them;

(5) Investigations of the support offered by subgrades to the various kinds of roadway, airport, and plant pavings.

After this brief introduction to soil mechanics, I shall now present a more detailed discussion of the specific subject.

The securing of foundation design data generally requires the performance of a foundation investigation, the purpose of which is to provide data concerning those physical properties of the soils which will influence the foundation design and, in many cases, the structural design. No foundation investigation should be undertaken without a reasonably thorough planning of the exploration program. It should also be expected that these plans may have to be revised as the investigation progresses and new information becomes available.

Before an investigation may be satisfactorily planned, it is necessary that some thought be given to the foundation requirements of the proposed structures. For example, a one-story steel-frame factory building would require a different type of foundation investigation

*Author Trent R. Dames is with Dames & Moore, civil engineers, Los Angeles.*

*This paper was presented at the meeting of the California Natural Gasoline Assn., Los Angeles, Sept. 6, 1945.*

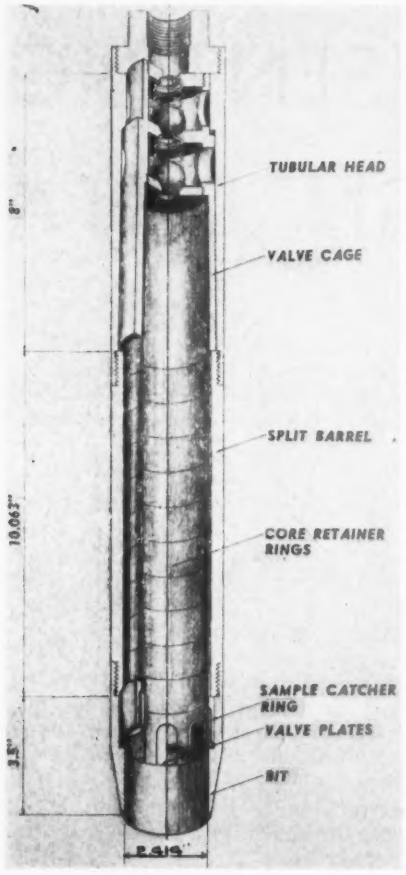



**Fig. 2—Sampler for securing undisturbed samples of soils in their natural state**

than a catalytic cracking unit, even though the soil conditions were identical.

Having in mind the foundation requirements, the foundation engineer will normally consult available geologic source data. Maps showing the grouping of geologic divisions often give data of great foundation significance. Areas which can be identified as geologically recent deposits generally contain soils of very recent origin, ranging from soft clay and silt near the ocean to firmer sandy loam and compact sand and gravel nearer the mountains. Soils associated with some of the geologically older deposits, while they may appear similar to the recent soils next to them, often have been appreciably consolidated and, in general offer much better foundation support than the recent deposits.

Unfortunately, however, the upper surface of these older deposits in many cases has been rendered unfit for foundation use by weathering and decay. The geologically older sedimentary deposits and igneous rocks offer adequate foundation support for practically any structure but present a variety of interesting problems in the stability of slopes, percolation of ground waters and construction of fills and subgrades from these materials. Fig. 1 is a simplified geologic map of the Los Angeles area, the grouping of geologic divisions chosen being that having the greatest foundation significance.

Old topographic maps are another source of valuable information, as they may indicate low swampy areas which were later filled or extended shore line areas which may cause difficulties in foundation construction. Aerial photographs are another source of valuable information, particularly in selecting sites for development. At certain seasons of the year, the color, type and density of the vegetation when seen from the air will disclose soils of differing geologic character. The records of other investigations and logs of wells and borings made in the vicinity should also be consulted. Unfortunately, in many cases investigations on adjacent property are made for other purposes and do not provide useful data. Well logs, in particular, are notoriously unreliable. Design and settlement records of buildings and structures in the vicinity should also be studied to furnish pertinent information.

After he has obtained all of the available structural and soil data, the foundation engineer will decide the number and depths of borings necessary to determine, with sufficient accuracy for engineering purposes, the foundation conditions on the selected site. The borings should determine the distribution of soil strata to the depth of influence of the pressures which will be imposed on the soils by the proposed foundations. The depth of influence is generally assumed to be two and one-half times the foundation width below the bottom of the foundation.

If very shallow exploration will be sufficient, the soils may be explored by the use of hand-dug pits. Ordinarily, however, the depth of influence is great enough to require the drilling of borings. These borings may be advanced by any one of several methods, depending upon which is best suited to the particular soil conditions.

The truck-mounted rotary-bucket type of drill rig is frequently used where the water table is low and the soils will stand in an uncased boring without caving. This type of drill rig rapidly drills a large diameter hole which an inspector can enter to examine the soil in place. However, this rig is not particularly suited to advancing borings below the ground water level and/or in caving soils. If explorations below the ground water table are to be made, wash-boring equipment is generally best suited. Unfortunately, such borings cannot economically be advanced through rocky fills and compact sand and gravel, in which case other equipment must be used.

Inasmuch as casing is always used with a cable-tool rig, this type of rig is particularly suited for drilling below the ground water level and is capable of advancing borings through rocky fills, compact sand, gravel and boulder deposits, and even bedrock. The use of any type of drilling equipment is not restricted to drilling on land as it may be mounted on barges and used in swamps and offshore explorations.

Regardless as to what particular method of exploration boring is selected, in order that full value may be realized from the explorations, undisturbed samples of the soils in their natural state must be secured. These samples are normally secured by driving a sampling device into the undisturbed soils at the bottoms of

**Fig. 3—Apparatus for making field load tests in soil studies. The data are obtained by loading a small test footing and measuring the resulting deflection. The load is added in increments, additional increments being added until the deflection has substantially ceased. These tests measure only the shearing strength of the soil**

UNDIVIDED RESPONSIBILITY IN ONE ORGANIZATION

The broad facilities and ample resources of the McKee organization enable us to undertake complete design, engineering and construction of refinery projects of any size in any domestic or foreign location.

**Arthur G. McKee & Company**

★ *Engineers and Contractors* ★

2300 CHESTER AVENUE · CLEVELAND, OHIO

30 Rockefeller Plaza, New York, N. Y.

Commerce Building, Houston, Texas

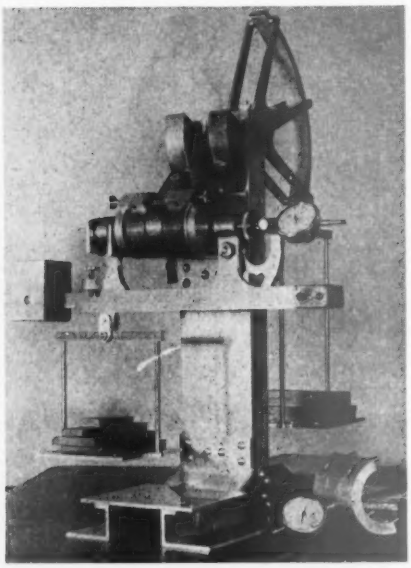


**Fig. 4—Laboratory apparatus for performing shear tests on undisturbed cores of soils**

the borings. The sampler illustrated on Fig. 2 consists of a tubular driving head, a split tubular barrel, and a tubular bit, one end of which is ground to a cutting edge. Into the driving head is fitted a valve cage designed to permit the upward passage of water but not its downward return; this tends to create a partial vacuum which helps to hold the sample in the barrel as the sampler is withdrawn. The barrel contains a series of core retainer rings which supports the sample throughout all handling and testing. Into the bit is fitted a catcher device which serves to close the opening after the core of soil has been taken and the sampler is being retracted.

There are many modifications and variations of the types of explorations which have been so briefly described. In addition to the outlined methods, jointed test rods or test piles may be advantageously driven when the sole purpose is that of sounding through soft overlying layers to determine the depths to the upper surface of a firm stratum below. This method may particularly be used when it is desired to interpolate information between exploration borings.

Geophysical means of foundation exploration, while probably offering many opportunities for development, have to date not met with very general usage in the field of foundation investigation These methods have been applied in determining the contours of the upper surface of rock beneath dam sites and in locating sand and gravel deposits.

It should be emphasized that foundation soil explorations, to be worth their cost, must be supervised by trained personnel and accurate and complete records obtained. Too frequently the drilling of exploration borings is carried out under the supervision of personnel whose education and training do not provide them with a background adequate for evaluating the relative importance of the data the explorations disclose as they progress, and for appreciating the significance of these disclosures in warranting changes in the prepared program of exploration.

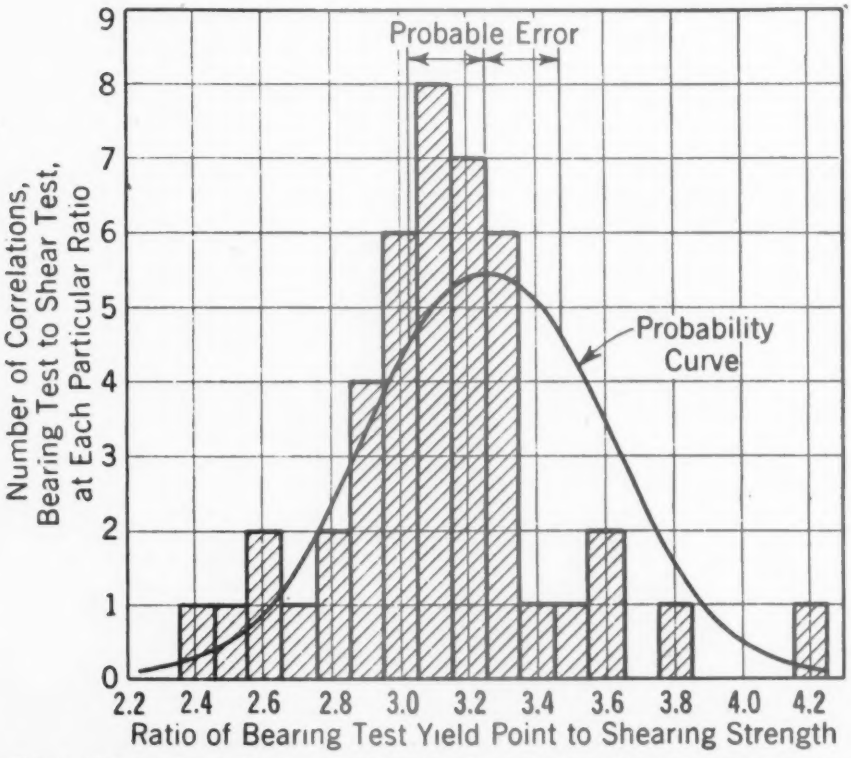



**Fig. 5—The results of 50 tests to determine the ratio of yield point bearing value to shearing strength were plotted to show the validity of this comparison, resulting in the probability curve shown above**

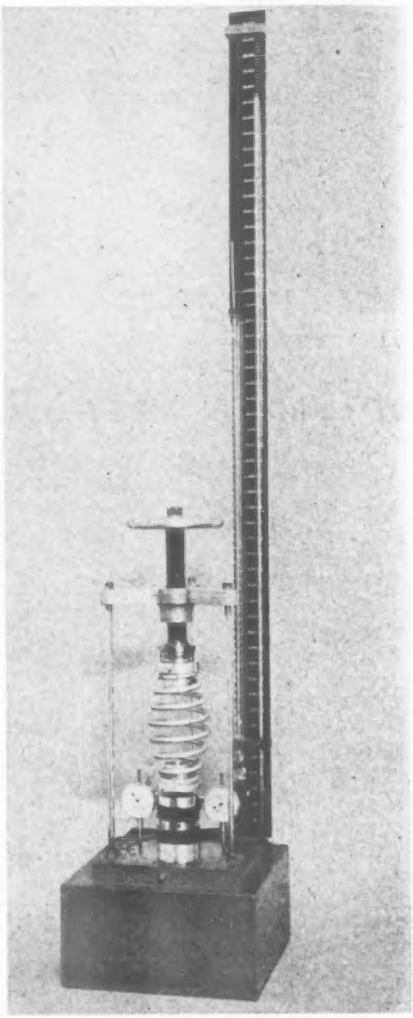


**Fig. 6—Apparatus used for determining compressibility of soils to be loaded by a foundation**

Field load tests, such as illustrated by Fig. 3, up until a relatively few years ago, were the only means of making physical measurements of the behavior of foundation soils. Essentially, these tests are performed by loading a small test footing and measuring the resulting deflection. The loads are applied in increments and the deflections measured by accurate means, as by micrometer dial gauges. Each increment of load is maintained until the deflection has substantially ceased.

The load-deflection curve obtained from these data describes only the behavior of a footing of the same size, at the same depth, and under the same conditions of confinement as the test footing. The curve usually consists of a straight line or approximately straight line portion followed by an increasingly curved segment representing an increasing deflection rate with increasing load.

All that field load tests of soils can actually measure is the shearing strength of the soils. Some ten years ago, Robert

V. Labarre, Frederick J. Converse, William W. Moore, the author's partner, and the author, investigated the possibility of substituting laboratory performed shear tests on undisturbed cores of soil for field load tests. A mathematical derivation of the relationship between the shearing strength and the load which may be imposed on a loaded area (that is, a footing), is to be found in Timoshenko's "Theory of Elasticity" and indicates that the bearing value is equal to Pi times the shearing strength.

In order to determine if the theoretical relationship, which was derived for an isotropic homogeneous elastic body, would apply to soils, experiments were conducted with shear tests performed on undisturbed cores of soil. One type of apparatus now used in the performance of such tests is shown in Fig. 4. A three-ring core of soil is subjected to normal, or axial, loads equivalent to the confinement that the soil is or will be under in the field, the center ring then being sheared from between the other two. A load-versus-shear-deflection curve is then plotted, from which the yield point shearing strength of the soil is determined.

A comparison of the yield point shearing strength with the bearing values obtained from field load tests indicated that the theoretical relationship was valid for soils within limits of engineering accuracy. A probability curve, Fig. 5, has been prepared by comparing the yield point bearing values determined by some 50 load tests on nearly every kind of soil and the results of shearing strength determinations on the same soils.

This curve indicates that, for any particular determination of shearing strength, the bearing value can be predicted within a probable error of approximately 10%, which is sufficiently accurate for engineering purposes. Inasmuch as a sample may be extracted and a shear test performed thereon for a fraction of the cost of a field load test, it is now practical to test samples obtained from a variety of depths and at a variety of locations over a site. Such procedure enables the determination of average values, which are far more reliable for design purposes than the results of a single load test or even several load tests.

Shear tests may also be used as a basis for calculating the supporting capacities of piling. If this is desired, friction tests should be made on materials used in the shear tests in order to determine the friction of the soils on the pile materials.

The shear test, however, determines only that unit load at which the soils will start to flow from beneath a footing; it does not permit a determination of how much a footing will settle under load. To obtain data concerning the compressibility of the soils to be loaded by a foundation, consolidation, or confined compression, tests are performed. Fig. 6 illustrates one type of apparatus used for the performance of these tests.

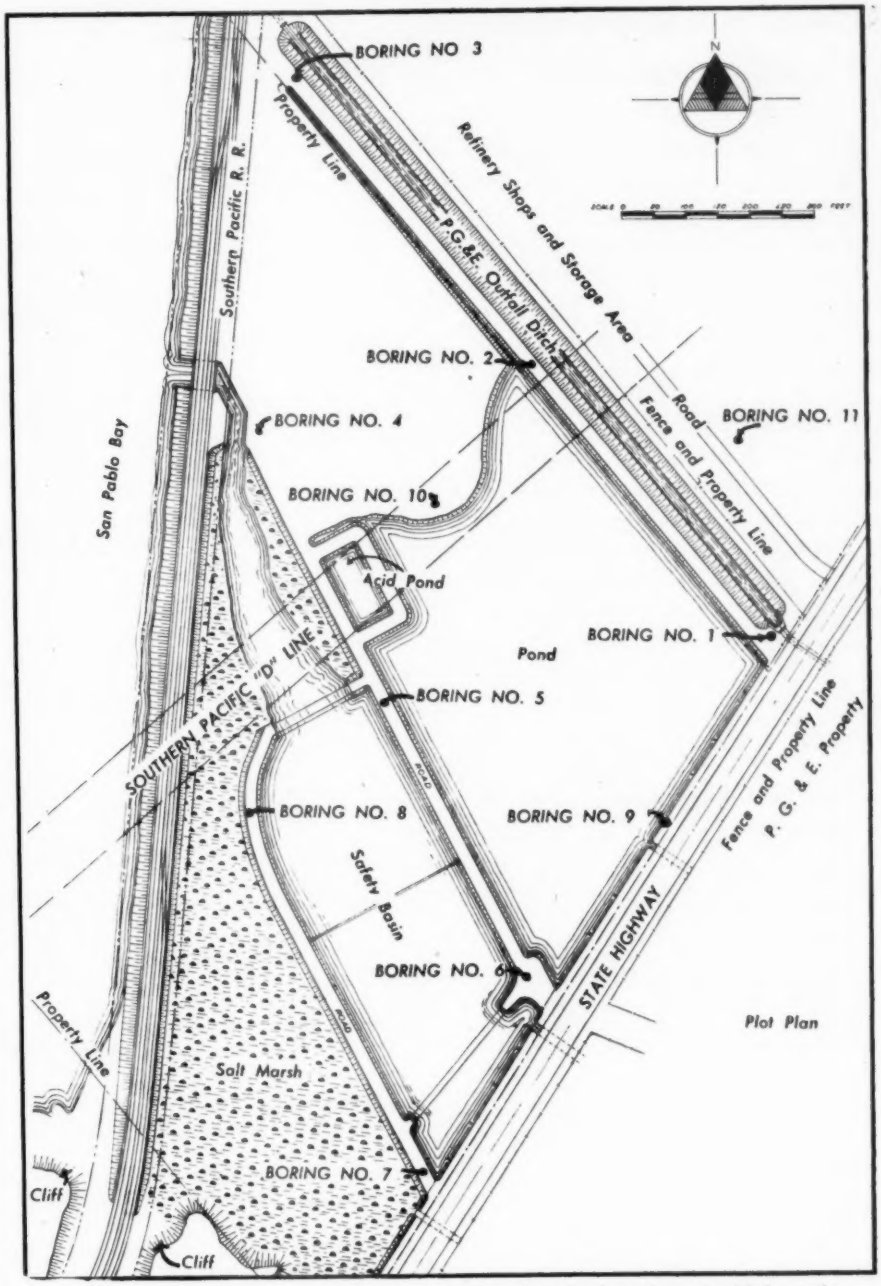



**Fig. 7—Plot plan for proposed refinery site, showing the location at which exploratory borings were made**

A confined sample of soil is placed between two porous stones, normal load applied in a series of increments and the compression with time recorded for each increment.

### Results Not Always Accurate

Unfortunately, the load-deflection curve obtained from the results of these tests will not plot as a straight line on an arithmetic scale. The shape of the curves obtained varies with the geologic history of the soil and other factors and does not follow any known laws. The general form suggests, however, that soils in compression have a modulus of elasticity which is some exponential function of the load. The data obtained from consolidation tests when used with curves indicating the distribution of compressive stresses beneath a loaded area permit the calculation of the settlements which may be expected for a particular footing. Unfortunately, the settlement calculations are not as accurate as the bearings value determinations; errors of on the order of 50% must be anticipated.

The shear tests and consolidation tests are the basic tests employed by the foundation engineer today. However, it might be well to mention several of the other types of tests which are used frequently.

Expansion tests are performed by permitting a core of the soil to absorb water by capillarity and measuring the expansion of the sample at various time intervals. The sample is subsequently re-

## ATTENTION ENGINEERS!

Second Printing of Complete Series

**PROCESS ENGINEERING DATA**

Now Ready in Booklet Form

All 7 of the articles by Dr. K. M. Watson and associates at the University of Wisconsin, which recently appeared in the TECHNICAL SECTION of National Petroleum News, have been reprinted in *full detail* and bound into one booklet.

These articles — a result of studies conducted at the University as part of its graduate research program in chemical engineering— deal with the development of improved methods of correlating and predicting fundamental physicochemical data — information important and necessary for efficient design and operation of modern refineries.

Here are the subjects covered in the series:

- ***Vapor Pressures and Critical Properties of Organic Compounds***
- ***Thermal Properties of Hydrocarbons***
- ***Thermodynamic Properties of Organic Compounds***
- ***Thermodynamics of Solutions — Ideal Systems at High Pressure***
- ***High Pressure Vapor-Liquid Equilibria***
- ***A Universal Viscosity Correlation***
- ***Pressure Drops in Granular Beds***

This time-saving reference booklet—48 pages, magazine size, complete with tables and illustrations —is bound in an attractive, durable cover.

**PRICE $1.00***

*(Ohio purchasers, add 3% sales tax)

***Mail your order to:***

**NATIONAL PETROLEUM NEWS**

**1213 West Third Street, Cleveland 13, Ohio**

**R-62**



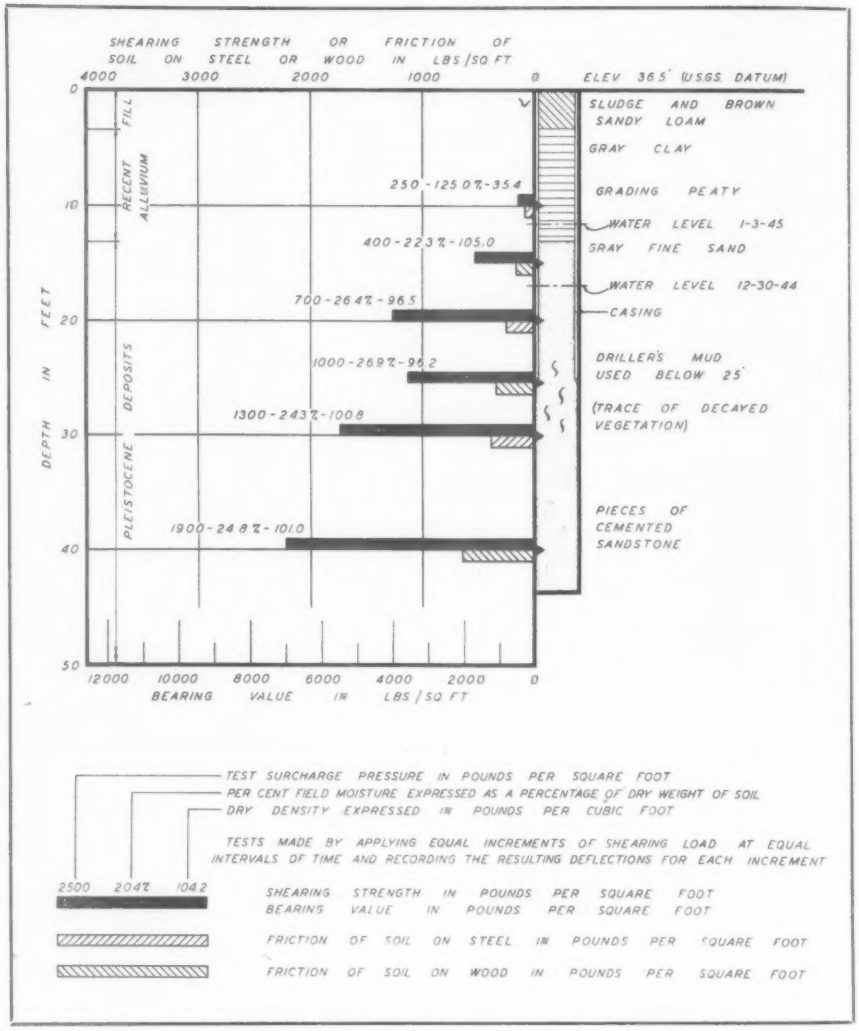


SHEARING STRENGTH OR FRICTION OF SOIL ON STEEL OR WOOD IN LBS/SQ FT
4000 3000 2000 1000 0
ELEV 365' (USGS DATUM)
FILL
RECENT ALLUVIUM
DEPOSITS
PLEISTOCENE
DEPTH IN FEET
0 10 20 30 40 50
250-125 0%-35 4
400-223%-105.0
700-264%-96.5
1000-269%-96.2
1300-243%-100.8
1900-248%-101.0
SLUDGE AND BROWN SANDY LOAM
GRAY CLAY
GRADING PEATY
WATER LEVEL 1-3-45
GRAY FINE SAND
WATER LEVEL 12-30-44
CASING
DRILLER'S MUD USED BELOW 25'
(TRACE OF DECAYED VEGETATION)
PIECES OF CEMENTED SANDSTONE
12000 10000 8000 6000 4000 2000 0
BEARING VALUE IN LBS/SQ FT
TEST SURCHARGE PRESSURE IN POUNDS PER SQUARE FOOT
PER CENT FIELD MOISTURE EXPRESSED AS A PERCENTAGE OF DRY WEIGHT OF SOIL
DRY DENSITY EXPRESSED IN POUNDS PER CUBIC FOOT
TESTS MADE BY APPLYING EQUAL INCREMENTS OF SHEARING LOAD AT EQUAL INTERVALS OF TIME AND RECORDING THE RESULTING DEFLECTIONS FOR EACH INCREMENT
2500 204% 104 2
SHEARING STRENGTH IN POUNDS PER SQUARE FOOT
BEARING VALUE IN POUNDS PER SQUARE FOOT
FRICTION OF SOIL ON STEEL IN POUNDS PER SQUARE FOOT
FRICTION OF SOIL ON WOOD IN POUNDS PER SQUARE FOOT

**Fig. 8—Graphical log for exploratory boring**

moved from the apparatus and allowed to dry at room temperature, after which it is further dried in an oven. The resulting contractions are measured for each case. This test is important in predicting the behavior of "adobe" soils, which are susceptible to large volume changes with changes in moisture content.

Compaction tests are frequently performed to determine the densities to which a proposed fill soil can be compacted by a given compacting energy. These tests determine an optimum moisture content at which the soil may most effectively be compacted using a specified compacting effort. When used in conjunction with shear tests and consolidation tests on cores prepared from the compacted soils, the tests enable the design of compacted fills for the support of foundations and pavements.

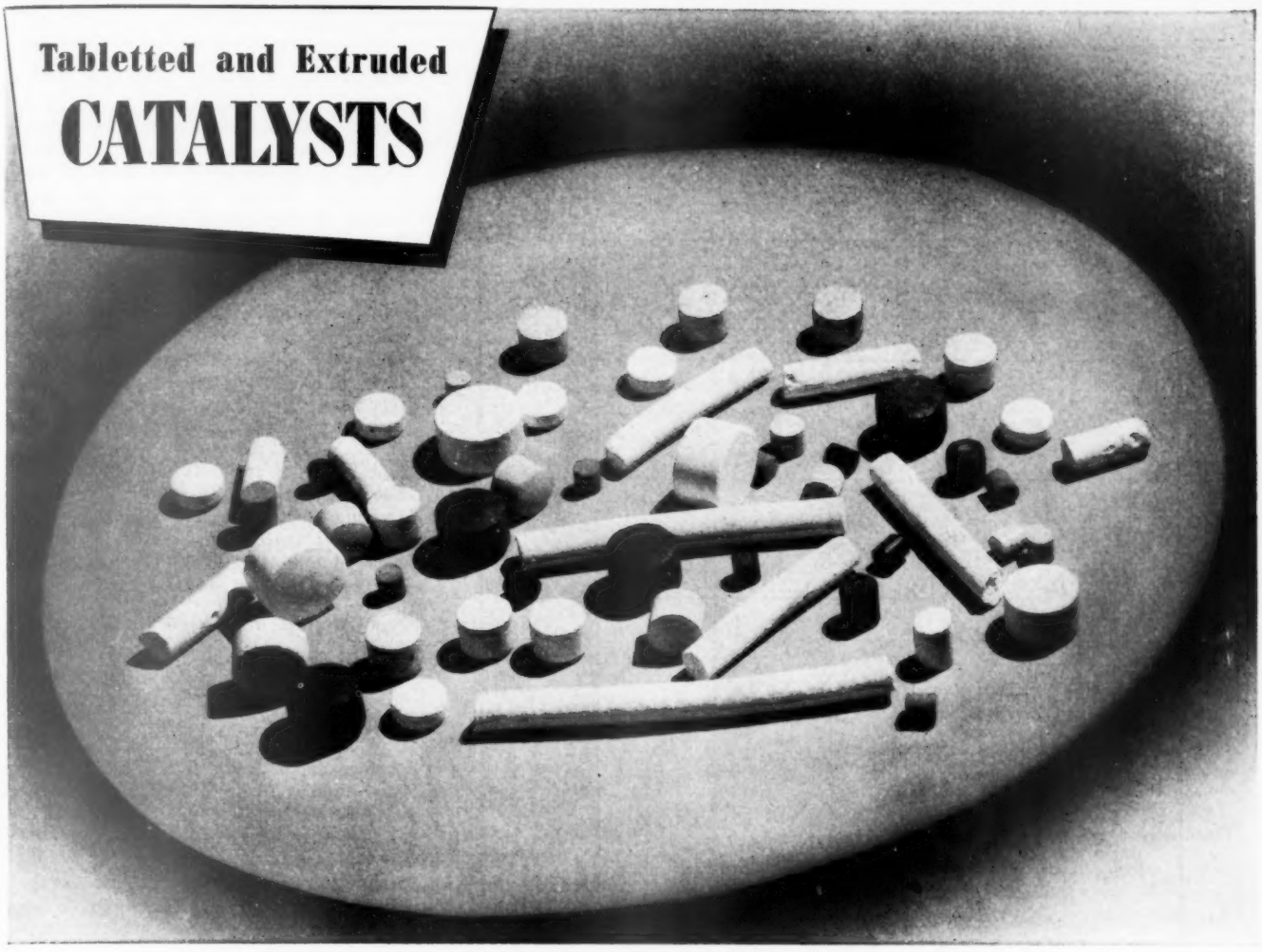
Percolation tests determine the resistance which the soils offer to the flow of ground waters. These tests are performed by placing a confined core of soil between porous discs and applying a surcharge equivalent to the confinement at which it is desired to study the sample. The confined sample is subjected to a known head of water, and the quantity of flow through the sample is measured over a period of time. These tests are useful in studying the time-rate of settlement of structures on certain types of soil; but their more particular use is in the design of earth structures, such as earth dams and levees.

Having performed the necessary explorations and tests, the foundation engineer has arrived at the point where most engineers begin their analyses and designs. A structural engineer, for example, is not required to perform investigations for each new job, as he has access to numerous data regarding the properties of the structural materials with which he works. It is his job to skillfully use and combine materials of known physical properties into a useful and economical structure. The foundation engineer, however, must first obtain the necessary data and then present these data in terms suitable for use by himself or others. So many variables are present that graphical means usually offer the most satisfactory medium for the presentation of these data and even graphs are inadequate in many cases.

In the graphical presentation of the data, a plot plan recording the locations

Tabletted and Extruded

# CATALYSTS



# *Uses for* PREFORMED CATALYSTS

## *are increasing rapidly...*

The petroleum industry and allied industries, both large and small, are finding new uses for tabletted and extruded catalysts supplied by Harshaw. • The use of these preformed catalysts marks another milestone in the rapid progress of these industries, which are well known for their ever-changing developments in refining and manufacturing processes. • Harshaw supplies preformed and other catalysts for **alkylation..oxidation..isomerization..dehydrogenation..hydroforming..hydrogenation..polymerization..dehydration..and various organic processes.**

***May we discuss your catalyst requirements with you?***

**CATALYSTS**
***Available in Preformed Shapes***

| | |
|---|---|
| Activated Alumina | Molybdena Alumina |
| Chrome Alumina | Tungsten Alumina |
| Chrome | Nickel |
| Cobalt | Phosphates |
| Iron | Thorium |
| Magnesia | Titanium |
| Molybdenum | Tungsten |

***We are Exclusive Sales Agents for***
**DIAMOND-HARSHAW**
***Preformed Catalysts***

D-H

***OTHER TYPICAL CATALYSTS***
**Anhydrous Hydrofluoric Acid • Aluminum Chloride**
**Boron Trifluoride • Anhydrous Hydrochloric Acid**

THE **HARSHAW CHEMICAL** CO.
1945 East 97th Street, Cleveland 6, Ohio
*BRANCHES IN PRINCIPAL CITIES*

HARSHAW

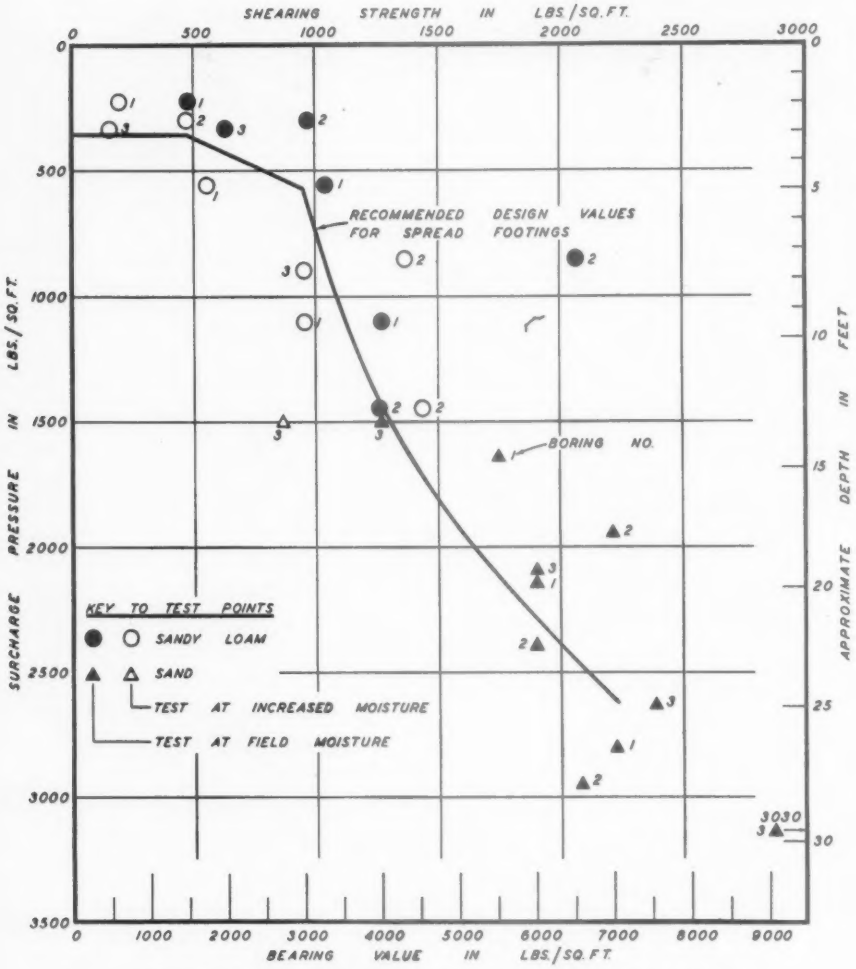

SHEARING STRENGTH IN LBS./SQ.FT.
0 500 1000 1500 2000 2500 3000
SURCHARGE PRESSURE IN LBS./SQ.FT.
0 500 1000 1500 2000 2500 3000 3500
APPROXIMATE DEPTH IN FEET
0 5 10 15 20 25 30
RECOMMENDED DESIGN VALUES FOR SPREAD FOOTINGS
BORING NO.
KEY TO TEST POINTS
SANDY LOAM
SAND
TEST AT INCREASED MOISTURE
TEST AT FIELD MOISTURE
0 1000 2000 3000 4000 5000 6000 7000 8000 9000
BEARING VALUE IN LBS./SQ.FT.

**Fig. 9—Typical summary of data from several borings**

at which the explorations were conducted is almost always required. The plot plan on Fig. 7, a proposed refinery site shows the relationship of the explorations to the property lines and existing structures.

The results of field explorations are almost always most effectively presented in terms of graphical logs, as in Fig. 8. This shows a typical log of boring on which is entered, in addition to the soil types and the observed fluctuations of the ground water, such pertinent data as whether casing was required or driller's mud used. The results of the shear and friction tests on samples extracted from the boring are usually presented in the form of bars on a graph adjacent to the graphical log. The upper scale of the graph indicates the shearing strength or friction strength of the soil, while the lower scale indicates the bearing value.

Usually the shearing strength and corresponding bearing values so presented cannot be effectively used unless the data from several borings are summarized. Fig. 9 shows a typical summary. Where the problem permits the use of such a simple presentation of the facts, a line is passed through the data, thus providing the structural designer with the bearing values which he may safely use at any depth.

In the case illustrated, the bearing value increased with depth in accordance with some physical law. Another common case is that of weak strata overlying a much stronger body of soil, which possesses a uniformly high bearing value but an irregular surface configuration. In this case, the depths to which foundations must be carried may advantageously be presented by subsurface contours describing the surface of this body. Often it is advantageous to show the arrangement of soil strata in the form of a subsurface section, as illustrated by Fig. 10.

### New Method of Computing Capacities

Very commonly the soils may be so soft as to preclude the utilization of spread footings for the support of any important structures, and the use of piling may be required. The author and his partner have developed a method of computing static supporting capacities of all of the various types of piling commonly employed. This method is based on the determined shearing strength and friction of the soils penetrated by the piling. The method permits an evaluation of the downward frictional drag which recent fills placed over soft soils frequently exert as the soft soils consolidate under the action of the loads of the newly superimposed fills. The results obtained from this method of analysis, a description of which is beyond the scope of this paper, have been verified by the performance of load tests on piling. Under most circumstances driving formulas provide wholly unreliable results. In most cases, the capacities indicated by driving formulas are extremely conservative, while in a few cases the formulas give a false sense of security, the error only being realized after the usefulness of the finished structure is destroyed by destructive differential settlements.

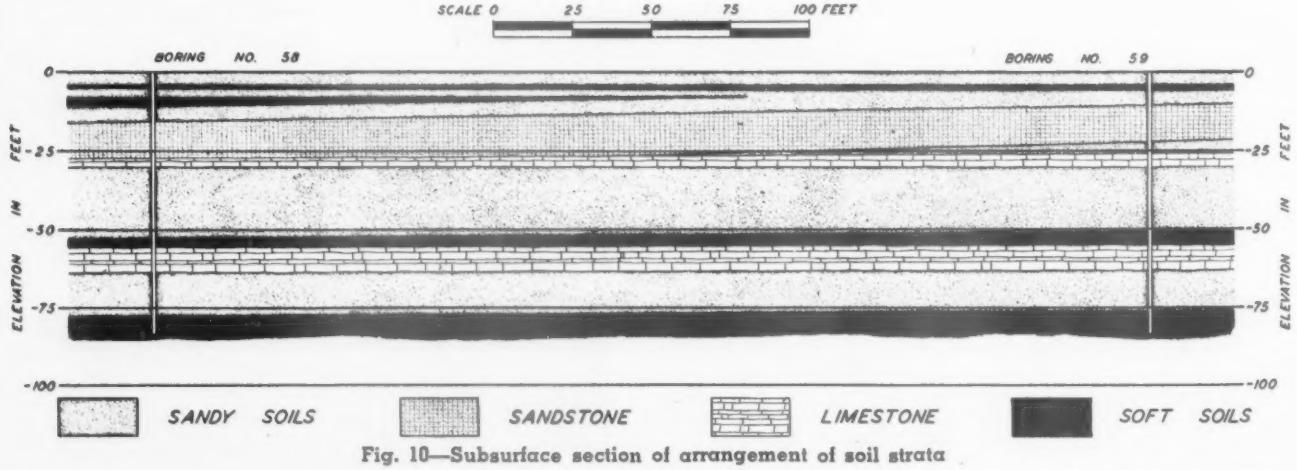



**Fig. 10—Subsurface section of arrangement of soil strata**

# Improved Petroleum Naphthas and Solvents Are Finding Many New Industrial Uses

*By B. H. Weil*
*Chief Information Specialist*
*State Engineering Experiment Station*
*Georgia School of Technology, Atlanta*

*and Fred B. Loeffler*
*Manager, Stock Oil Sales*
*Lubricating Sales Department*
*Gulf Oil Corp., Pittsburgh*

**Although straight-run naphthas are still the most widely used industrial solvents produced from petroleum, new types of these materials are being developed to meet specialized applications. Most important of the new solvents are highly-aromatic naphthas and technically-pure hydrocarbons. Increasingly wider usage of both the straight-run and aromatic naphthas is forecast, based on their good solvent properties, essentially nontoxic character, low cost and ready availability.**

**The general properties and uses of the various petroleum naphthas and solvents are described in this article, appearing exclusively in the NPN Technical Section.**

ALTHOUGH industrial petroleum naphthas and solvents are among the few materials which find some use in practically every present-day manufacturing operation, they are probably the least publicized group of products derived from crude petroleum.

During the war, the general public was constantly reminded of the huge quantities of high-quality aviation gasoline which were going to our air forces, the tremendous quantities of fuel oils required to power the largest Navy the world has ever known, and the unheard-of volumes of lubricants needed to keep all this machinery operating smoothly. However, the chances were probably 100 to 1 that most of this war equipment depended to some extent upon the use of industrial petroleum naphthas and solvents.

These materials may be defined as selected fractions of the lighter, more volatile constituents of crude petroleum, chemically refined and separated into various boiling ranges to make them adaptable to the almost endless number of uses which they find in industry. In general, these naphthas and solvents are capable of complete evaporation at atmospheric temperatures and have pronounced solvent action on oils, fats, resins, waxes, etc., without altering their chemical composition.

About 60 years ago, the first type of industrial naphthas was introduced as a thinner for paint and consisted of what would today be considered nothing more than a poorly refined motor gasoline. Results obtained were naturally unsatisfactory. Today, the manufacture of industrial petroleum naphthas and solvents has become highly specialized, and these products are made to the most exacting specifications.

The most generally-used types of these petroleum products might be classified as follows: (1) straight-run petroleum naphthas, (2) highly-aromatic petroleum naphthas, and (3) technically-pure hydrocarbons from petroleum.

In the first classification, there are an endless number of special, close-cut fractions, but the best-known and most widely-sold of this type of industrial naphthas are: (1) rubber solvent; (2) benzol diluent, or textile spirits; (3) lacquer diluent; (4) V. M. & P. naphtha; and (5) mineral spirits and Stoddard solvent.

There are three principal products in the second classification, with boiling ranges controlled to give evaporation rates approximating those of straight-run lacquer diluent, V. M. & P. naphtha, and mineral spirits. In the third classification, the two principal solvents are 2° toluol and 10° xylol.

Before highly-aromatic petroleum naphthas became available, straight-run petroleum naphthas were often blended with various coal-tar solvents to give products with the desired characteristics for a particular purpose. With the advent of highly-aromatic petroleum naphthas, however, this blending could in many cases be eliminated, although some large paint manufacturers continued to blend straight-run naphthas with toluol and xylol, enabling them to "tailor-make" a wide variety of solvents for each specific application.

## Important Tests

Before discussing the many uses for petroleum naphthas and solvents, it might be well to review the numerous tests which are used to control their properties and to insure uniform quality. While it would be impractical in this article to detail the methods of performing these tests, a brief description of their significance seems in order and is given in Table 1.

## Uses

It is evident, from what has been said, that most petroleum naphthas and solvents, particularly the straight-run variety, are prepared with a somewhat limited number of large-scale uses in mind and then used, in addition, for a wide variety of other purposes for which alterations in specifications are not required.

### Mineral Spirits

Stoddard Solvent, for example, is a naphtha which meets or exceeds the specifications of "Commercial Standard CS3-40," set up by the Bureau of Standards. According to these specifications, the

**Petroleum solvents are frequently used for cleaning metal parts of all descriptions, as shown in the photograph below in which the parts of a disassembled airplane engine are being washed free of grease and other foreign matter**

*(Photos courtesy Gulf Oil Corp.)*

## TABLE I—Important Tests for Petroleum Naphthas & Solvents

**A.P.I. Gravity** is a numerical index of the weight of a measured volume of solvent at 60° F. Gravity is of little significance as an index of quality. Its chief value is in the control of refinery operations, in computing weights, making volume corrections, etc.

**Flash Point,** for solvents and naphthas, is usually determined by means of the Tag Closed Tester, in accordance with the prescribed A.S.T.M. methods. Fire hazard is of course the principal consideration in determining the flash point of naphthas, and this test is generally recognized as the best index of the probability of ignition.

**Copper Strip Corrosion Tests** indicate the presence of corrosive sulfur compounds, which might attack metals or cause the darkening of paints or varnishes. The most severe of the copper corrosion tests involves placing a copper strip in the solvent to be tested and boiling gently for 30 minutes. Blackening of the strip may indicate corrosive constituents or constituents which decompose and become corrosive at the temperature involved, or both.

**Sulfur Content** is determined quantitatively in accordance with prescribed A.S.T.M. methods and is important in lacquer formulations, where excess sulfur may cause darkening of the finished product.

The **Doctor Test** is essentially a sensitive qualitative chemical test for hydrogen sulfide and mercaptans and, contrary to a belief frequently held, does not give an indication of the total quantity of sulfur in a naphtha. It also fails to indicate the presence of free sulfur, usually the corrosive agent; and the mercaptans, which it does determine, are generally not corrosive. For the detection of corrosive sulfur compounds, this test is decidedly inferior to the copper strip test.

The **Odor** of a completely refined naphtha is usually termed "normal" or "sweet". Objectionable odors are usually due to traces of certain sulfur compounds, resulting from incomplete refining. At the present time, there is no standard test covering this property.

**Color** is generally measured by the Saybolt Chromometer, in accordance with the prescribed A.S.T.M. methods. It is of definite importance for most uses of petroleum naphthas and solvents, particularly in the dry cleaning and paint industries. There are, of course, cases where color has little significance, such as the use of a solvent for asphaltic materials.

**Acid Heat** gives an indication of the quantity of unsaturated hydrocarbons, which are unstable and may therefore react with the ingredients added to a particular formulation.

The **Aniline Point** is the minimum equilibrium solution temperature for equal volumes of aniline and the naphtha being tested. This test is primarily one for solvent power. The lower the aniline point, the greater is the solvent power of the naphtha. Determination of **Mixed Aniline Point** is a variation of the above test and is used in lieu thereof for high solvency naphthas having regular aniline points which fall at temperatures below the freezing point of aniline or too low for easy determination. This test is similar to that for the regular aniline point, except that the solvent to be tested is diluted with an equal volume of n-heptane of specified purity.

The **Kauri-Butanol Number** of petroleum solvents and naphthas is one of the properties most widely used in the paint and varnish industries. It is a measure of solvent power for the certain types of gums most used by these industries. The higher the K.B. number, the greater is the solvent power of the naphtha. Within limits, it has been indicated that there is a fairly close relationship between Kauri-Butanol value and the aniline point, the K.B. value decreasing almost linearly with increase in the aniline point.

The standard **Distillation Test** of the A.S.T.M. is one of the most frequently used tests by both purchasing and manufacturing departments. Initial boiling point, 50% distillation point, end point, and uniformity of intermediate boiling points have great significance to those familiar with this test. While volatility, drying rate, etc., are directly connected with boiling range, this test cannot be considered an absolute indication of the rate of evaporation to be expected.

The **Spot Test,** although frequently specified for paint and varnish thinners to determine if the product is free from constituents that do not readily evaporate, is not very satisfactory and is a rather unscientific substitute for properly-interpreted distillation data. Its only real virtue is its simplicity.

**Dimethyl Sulfate Value** indicates the amount of naphtha absorbed in equal quantities of a mixture of naphtha and dimethyl sulfate, giving an indication of the percentage of aromatic hydrocarbons present, or an indication of solvent power; the higher the dimethyl sulfate value, the greater the solvent power. Although this test gives only approximate results, it is more rapid than most solvency tests.

**Dilution Ratio** shows the extent to which a solvent for nitrocellulose, such as butyl acetate, will stand dilution with a nonsolvent or diluent before precipitation of the nitrocellulose occurs. This is one of the most satisfactory methods of comparing thinners for lacquers and artificial leather dopes. Naphthas with high solvent power naturally show high dilution ratios. However, if a small quantity of butyl alcohol is added, it is sometimes possible to use more nonsolvent in a given formula than might be indicated by this test.

**Iodine and Bromine Numbers** measure the concentration of unsaturated hydrocarbons which may oxidize to form gums and may discolor solvents even on standing. Although iodine is readily absorbed by unsaturated hydrocarbons, it also has a tendency to substitute for hydrogen and to add to aromatic unsaturated bonds that may be present. Therefore, this test, although widely used, does not really furnish accurate information. The two commonest tests for iodine number are the "Hanus Method" and "Wijs Method" and the best known test for bromine number is the "Francis Method."

**Resin Solvency** measures the effectiveness of aromatic naphthas as resin solvents and may be determined either by measuring the viscosity of solutions or the tolerance of solutions or low-solvency mineral spirits.

**Acidity of Residue** is determined from the undistilled material remaining after the standard distillation test, in order to detect any traces of acid which may have been contained in the solvent.

Stoddard solvent as received should be a petroleum distillate which conforms to the following requirements (when tested according to standard methods given in the Department of Commerce publication):

(1) Appearance—Shall be clear and free from suspended matter and undissolved water.

(2) Color—Shall be water-white or not darker than 21 by Saybolt chromometer.

(3) Odor—Shall be sweet.

(4) Flash Point—Shall not be lower than 100° F. ("Tag" closed tester).

(5) Corrosion Test—A clean copper strip shall show not more than extremely slight discoloration when submerged in the solvent for three hours at 212° F.

(6) Distillation Range—The 50% point shall not be above 350° F., and the end point shall not be higher than 410° F.

(7) Acidity—The residue remaining in the flask after the distillation is completed should not show an acid reaction to methyl orange.

(8) Doctor Test—Shall be negative.

(9) Sulfuric Acid Absorption Test—not more than 5% of the solvent shall be absorbed by concentrated sulfuric acid (93.2%).

These standards, and the similar ones of the A.S.T.M., were set up especially for the dry cleaning industry so that it could be assured of the provision of safe and noninjurious solvents for its operations.

Nevertheless, the Stoddard solvents and related mineral spirits are widely used in numerous industries not at all related to the cleaning of fabrics: (1) as solvents and/or thinners for oil paints, varnishes, and enamels; (2) as a constituent of polishes for furniture, automobiles, shoes, metals, and stoves; (3) as a constituent of water-proofing compounds containing wax or asphalt; (4) as metal cleaning agents, such as for removal of cutting oils from metal parts and the cleaning of automobile and airplane motors and printers' type and rolls; (5) as a constituent of rust preventives; (6) as a leather degreasing agent; (7) as solvent and/or thinner for protective and decorative coatings on linoleum; and (8) as rosin extraction solvent in the manufacture of turpentine and pine oil.

Mineral spirits also find many other uses, too numerous to mention here. Specifications may vary somewhat; for example, Gulf prepares a special product in place of Stoddard solvent for sale in Tennessee and Texas. This naphtha possesses the high flash point (above 112° F.) required in these states, yet still meets other CS3-40 specifications.

Stoddard solvents, of course, are prepared from straight-run paraffinic crudes, since they must be chemically inert and must not cause "bleeding" in colored fabrics nor dissolve out the natural oils and greases, which would leave the materials dull and lifeless. A happy compromise is sometimes possible, however, as, for example, solvents which pass CS3-40 specifications yet possess high enough solvent power for use as a solvent or thinner for paints.

Where uses other than dry cleaning are intended, mineral spirits are often not manufactured to meet Stoddard solvent specifications. Some solvents for example, are made from naphthenic crudes in order to secure higher solvency for certain gums and resins and, in addition to the many other uses listed above, are employed as an ingredient in "naphtha" soaps to increase cleansing power.

### Rubber Solvent

Straight-run petroleum naphthas are used in the rubber industry for (1) the manufacture of tires, in which they are used to dampen the ply and tread stocks to secure better adhesion between the units of the tire during the building operations, and (2) the production of rubber cements. The latter may either be sold for use as adhesives or used in the fabrication of rubberized cloth, hot water bottles, bathing caps, gloves, overshoes, toys, etc.

The desirable characteristics of a rubber solvent may be enumerated as follows: (1) satisfactory solvent or dispersing power for rubber; (2) absence of chemical action on rubber; (3) stability toward oxygen, moisture, and (for cold-curing) sulfur chloride; (4) minimum flammability; (5) suitable boiling point; i.e., the naphtha must not be too volatile for general use nor be so high boiling that it cuts down drying speed or requires a temperature for evaporation sufficiently high to harm the rubber; (6) absence of objectionable odor; and (7) essentially nontoxic character.

Solvents containing more than a small amount of unsaturated hydrocarbons, such as cracked petroleum distillates, are generally undesirable as rubber solvents, especially when used as a diluent for sulfur chloride in cold vulcanization, since chemical reaction with this vulcanizing agent would lead to its premature exhaustion, thus impairing the vulcanization process. Products of poorer aging

**Petroleum naphthas are an important constituent of rust preventive compounds, in which the 105 mm. howitzer tube shown above is being slushed**

characteristics may also result from the use of such solvents, because of parallel oxidation tendencies.

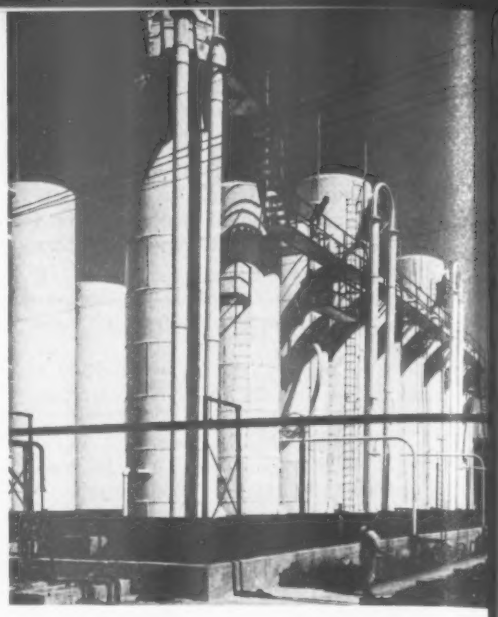
The petroleum naphthas used in a number of rubber cements and in dipped goods usually have higher initial points than those employed in tire manufacture. An initial boiling point below 65° C. (149° F.) is undesirable for cement purposes, because of larger volatilization losses in making and handling the cement, less solubility for the rubber, and "blushing" of the applied cement as the result of condensation of moisture. High initial boiling point gives much greater protection from blisters, and considerably reduced evaporation losses in the dipping tank and in the manufacture of the cement used. Low end point, of course, gives greatly increased production possibilities in the dip goods plant.

All of the preceding data are concerned with natural rubber which, of course, was in extremely short supply during the war, various synthetic elastomers being used, as at present. The conventional aliphatic petroleum naphthas normally used in the manufacture of rubber cements and rubber articles do not possess sufficient solvent power to be used satisfactorily with those synthetics, such as GR-I (Neoprene) and GR-A (Buna-N), whose greater solvent resistance demands the use of aromatic petroleum solvents and/or aromatic solvents.

However, GR-S (Buna-S), the general-purpose synthetic rubber provided in the greatest quantities, does not differ greatly from natural rubber in its reaction to petroleum naphthas, although it possesses less tack.

### Benzol Diluents

Benzol diluents, or textile spirits as they are sometimes called, are used as: (1) a diluent for the manufacture of spray and textile lacquers and synthetic resin finishes; (2) as a constituent of nitrocellulose and rubber water-proofing compounds; (3) as a constituent of dyes employed for printing textile fabrics; (4) as a diluent in the synthetic plastics industry; (5) as a solvent for the extraction of such vegetable oils as castor, flaxseed, soybean, cottonseed, and olive; (6) as a solvent or diluent in the manufacture of rubber and nitro-cellulose cements; (7) as a solvent and/or diluent for the manufacture of oil-cloth base and nitrocellulose-type artificial leathers; (8) as a diluent in rotogravure printing inks and certain types of lithographic inks and varnishes; and (9) as a solvent in the refining of tall oil.



**Good plant housekeeping, such as is evidenced in this doctor sweetening unit, is conducive to the careful refining required to produce petroleum naphthas and solvents of uniformity and purity**

**Numerous samples are taken during the many refining steps required in the preparation of high-quality petroleum naphthas and solvents, and are stored for testing and future checking**

### Lacquer Diluents

Lacquer diluents, as commonly defined, are straight-run naphthas which, while not themselves solvents for cellulose nitrate, may be used with other and more expensive solvents both to reduce the cost and to adjust the viscosity of the lacquer. Slightly lower boiling ranges than those of the true solvents are provided in these naphthas in order to insure even deposition rather than precipitation from a non-solvent. Lacquer diluents also find uses in the extraction industries where a naphtha of slightly higher boiling range than benzol diluent is required.

### V. M. & P. Naphthas

Varnish Makers' and Painters' naphthas include a wide variety of products. A naphtha satisfactory for paints, for example, should possess: (1) suitable volatility, permitting such evaporation as to leave a good, durable film; (2) suitable solvent power for paint constituents; (3) stability, in order not to go off color or develop an unpleasant odor; and (4) freedom from harmful or corrosive impurities, such as certain types of sulfur compounds.

Varnishes are solutions of resins, a drier, and a solvent and/or thinner, to which oils may be added; these finishes harden partly by evaporation, but mainly

by oxidation. Three types of resins are much in use: fossil, nonfossil, and synthetic. The solvents and thinners most used are straight-run petroleum naphthas, turpentine, and highly aromatic petroleum naphthas; with solvent power, in general, increasing in the order given, so that straight-run petroleum naphtha usually acts as a thinner and aromatic petroleum naphtha, for example, as a solvent. This distinction rests on the ability to dissolve the solid, film-making constituents. There are cases where petroleum naphthas and turpentine may have solvent power as well as thinning value.

V. M. & P. naphthas in many cases find other uses than those implied in the name. They may be used as a solvent or diluent employed in the manufacture of water-proofing compounds (such as where a quicker drying solvent than Stoddard solvent is desired), in mildew-proofing canvas duck, in the manufacture of certain plastics, etc.

### Aromatic Petroleum Naphthas

As mentioned, highly-aromatic petroleum naphthas are usually sold in boiling ranges which approximate those of straight-run lacquer diluent, V. M. & P. naphtha, and mineral spirits. Unlike these latter, however, they are seldom prepared simply by controlling distillation range and purity, since even aromatic crudes do not usually contain the desired concentrations of aromatic compounds.

Instead, aromatic petroleum naphthas are generally prepared by methods which increase the content of the aromatics already present, such as (1) by the Edeleanu (liquid sulfur dioxide) extraction of distillates from highly aromatic crudes, or (2) by altering the structure of the hydrocarbons present, causing the aromatic content to be increased by cyclization of paraffins and the dehydrogenation of these and naturally occurring naphtheres. Hydroforming is a typical example of the latter processes.

Aromatic petroleum naphthas compete with coal-tar distillates for solvent uses where their properties permit application and where their somewhat lower costs render their use attractive.

As mentioned, the solvent power of naphthas for paints, lacquers, and enamels (especially where synthetic resins are involved) is roughly proportional to the aromatic character of the constituent hydrocarbons. During the war, when aviation gasoline and toluene conversion competed for these aromatic petroleum naphthas, principal uses included the extraction of pharmaceuticals and vitamins and the coating of various textiles (canvas flameproofing, barrage balloon coating, etc.).

These naphthas are considerably more expensive than straight-run paraffinic and naphthenic petroleum naphthas and solvents, so it is evident that this group occupies an intermediate place in two respects between the former substances and the pure aromatics (whether from coal-tar or petroleum).

### Technically Pure Hydrocarbons

The most important members of this petroleum-derived group, as mentioned, will probably be 2° toluene and 10° xylene, which aromatics will compete directly with their coal-tar equivalents.

Some demand has also arisen for very close-cut, straight-run petroleum naphthas, usually prepared by extremely close fractionation. Commercial hexane and heptane are typical of these solvents, whose narrow boiling ranges and evaporation curves offer attractions for those extraction systems, rubber cements, adhesives, and finishes where added cost is overbalanced by bettered control and lowered losses.

° ° °

It has not been possible, in this discussion, to go far into the many details which govern the selection of a particular naphtha for a specific use. In general, the most widely used (and hence most inexpensive and readily available) petroleum naphthas and solvents — the straight-run naphthas such as Stoddard solvent, V. M. & P. naphtha, rubber solvent, benzol diluent, and lacquer diluent —are applicable to most of the many uses to which petroleum naphthas are being put.

In other cases, of course, the desire for certain specific qualities places a premium price on their attainment, and for such uses the petroleum industry is providing the highly-aromatic petroleum naphthas and the various technically-pure hydrocarbons. These latter groups may well be diversified in the future, but the volume of demand should continue to fall well below that for the straight-run petroleum naphthas and solvents.

All of these naphthas are destined for wider usage in greater quantities. This is the result of a more general recognition of their inherent qualities and advantages, such as good solvent properties, essentially nontoxic character, low cost, and ready availability. That a material of such unique character and great utility can be bought at about the price of bottled drinking water (for certain straight-run naphthas, at least) is one of the miracles of the modern petroleum industry.

### Selected References


*Industrial Petroleum Naphthas*, Lubricating Sales Department, Gulf Oil Corp.-Gulf Refining Co. (Pittsburgh), 1943.

*Industrial Solvents*, Ibert Mellan, Reinhold Publishing Corp. (New York), 1939.

"Petroleum Solvent Naphthas", E. H. McArdle, *NATIONAL PETROLEUM NEWS, Technical Section*, 36, No. 14, R-188 (1944).

"Petroleum Solvents", E. M. Toby, Jr., *Industrial and Engineering Chemistry* 35, No. 10, 1044 (1943).

*Significance of Tests of Petroleum Products*, American Society for Testing Materials (Philadelphia), 1937.

*The Spotting Department*, National Association of Dyers & Cleaners of U. S. and Canada (Silver Spring, Md.).



**NOW AVAILABLE**

**First Comprehensive Postwar Book On Modern Refining Processes**

**AMERICAN PETROLEUM REFINING**

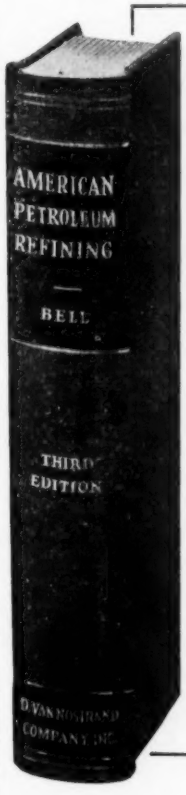
**By H. S. Bell**

This NEW edition of *American Petroleum Refining* by H. S. Bell, consulting engineer of long experience in the petroleum industry, contains *all* the most up-to-date developments in petroleum technology . . . From the crude storage tank to the finished product, *every step* in modern refinery engineering and operation is *given in full.*

The methods of calculation of the chemical, physical and engineering data needed in practical design are fully explained, with the information arranged in hundreds of comprehensive tables and graphs, and with sample problems to show you every step in its application to your needs. Photographs and diagrams illustrate refinery construction. Included are flow sheets of processes and details of apparatus. Each important class of refinery equipment is the subject of an entire chapter, which covers its design from the basic principles and calculations down to the details of construction.

**640 pages** **Illustrated and Indexed**
**Cloth bound** **Size 6¼ x 9¼** **Price $7.50***

*(Ohio purchasers add 3% sales tax)*




**Chapter Headings**

General Introductory
Crude Oils and Their Characteristics
Chemical Properties
Physical Properties
Physical and Engineering Data
The Manufacturing Process
The Refinery Side and General Arrangement
Distillation
Heat Transfer
Fractionation
Shell Stills
Pipe Heaters
Condensers and Heat Exchangers
Distillation Units
Cracking, Theory and Development
Thermal Cracking
Catalytic Cracking
Motor Fuels
Special Processes for Motor-Fuel Blending Agents
Chemical Treatment
Dewaxing
Refrigeration
Solvent Extraction
Filtration
Blending and Compounding
Packages
Storage of Oil
Volume Measurements
Evaporation Losses
Fire Protection
Power and Boiler Houses
General Departments
Pumping of Oil
Bulk Transportation
The Problem of the Future

Address your order for the new edition of AMERICAN PETROLEUM REFINING to:

**Book Department**

**NATIONAL PETROLEUM NEWS**

**1213 West 3rd Street, Cleveland 13, Ohio**

# Output of Synthetic Chemicals From Oil Up, U.S. Report Shows

PROOF that petroleum compounds as raw materials are becoming more and more a factor in the production of synthetic organic chemicals is indicated by preliminary U. S. Tariff Commission statistics, "Report on Production and Sales of Synthetic Organic Chemicals in the United States, 1943."

First listed in the 1942 report, chemical intermediates derived from oil again are listed, as well as other compounds originating from petroleum. The data are not as spectacular as might be expected, however, because of the exclusion, for security reasons, of toluene or TNT production, and those chemicals included in the manufacture of aviation gasoline, since they do not enter the usual channels of commerce.

Chemical raw materials derived from petroleum totaled 1,564,914,665 lbs in 1943, an increase of about 500,000,000 lbs from 1942. Sales of 1,067,058,199 lbs were reported, based on a unit value of 3.2c per lb for the sum of $34,435,706. Figures for the individual materials are shown in Table 1, but it excludes toluene from petroleum at refineries not under control of Army Ordnance.

### Toluene Production Up 36%

Toluene production from light oil, tar and petroleum (except at Ordnance plants) was 163,678,000 gal, 120,000,000 gal more than 1942 production. This increase, the report says, "was due chiefly to the greater output from the petroleum plants."

It would be of considerable interest to have petroleum toluene figures from all sources. It seems reasonable to conclude that these unreported Ordnance plants probably produced another 100,000,000 gal of toluene largely from petroleum. The output of one petroleum plant in Texas is known to have supplied enough toluene to account for half the bombs used by the United Nations since Pearl Harbor, and two-thirds of the TNT used in United Nations bombs has come from oil.

### No Estimates for Benzene Production

No direct oil figures are given for benzene production; since much is produced from coal-tar crudes, this value cannot be separately estimated. However, total benzene production was 167,033,000 gal with "motor benzene" amounting to 24,604,000 gal; the latter dropped 44,000,000 gal from 1942 levels, according to the report, while the 1943 total production exceeded 1942 total by about 8,000,000 gal. Reason assigned to the "motor benzene" drop was diversion of the material to manufacture of synthetic rubber and aviation gasoline.

Other chemicals derived from petroleum sources are not so clearly delineated in the report. However, a large proportion of the synthetic rubbers were derived from petroleum sources; total elastomer production is shown in Table 2. Some of the Thiokol types covered in the report, as well as other materials, are included in one group to avoid disclosure of individual company operations. Total elastomers produced in 1943 was 573,159,000 lbs, 555,569,000 lbs were sold, and value realized was nearly $157 million. Obviously, these figures were far below 1944 production.

### Production of Other Petrochemicals

A number of other chemicals were directly attributed to petroleum in the Tariff Commission report. Cyclic sulfonated petroleum compounds were reported as 33,224,079 lbs, and non-cyclic sulfonated petroleum compounds as 6,681,376 lbs. The cyclic petroleum compounds sulfonated were the major item in the cyclic group, which totaled in excess of 4 million lbs; petroleum noncyclics were not the major item in their group, totaling nearly 45 million lbs, but were among the largest single classification.

These materials are classified as "surface-active." They commonly are used as wetting agents, synthetic detergents, soaps, etc. It would appear that the chemical industry must depend on oildom for nearly half the raw materials for "surface-active agents."

The sale of anti-oxidants and inhibitors depends to a large extent on the quantity of gasoline made and sold, even though petroleum products themselves may not play a large part in their manufacture. The report states that 6,636,578 lbs of cyclic gasoline anti-oxidants and inhibitors were made in 1943, while more than 7,000,000 lbs were sold at an average price of 54c per lb. Another item in this same list is also of interest—5,489,841 lbs of insecticides were made, more than 4,000,000 lbs sold. Here again petroleum may not have served as a raw material for these compounds, but nevertheless is extensively used as a vehicle in their application.

TABLE 1—Chemical Raw Materials Derived from Petroleum Production and Sales, 1943

| Product | Production, lbs | Sales | | |
|---|---|---|---|---|
| | | Quantity, lbs | Value, $ | Unit value per lb, $ |
| A. "Crudes" from petroleum: | | | | |
| Cresylic acid | 13,915,900 | Note 1 | Note 1 | .... |
| Naphthenic acid | 17,341,192 | Note 1 | Note 1 | .... |
| B. Hydrocarbons: | | | | |
| 1,3-Butadiene, grade for rubber | 103,091,279 | 97,506,891 | 20,914,967 | .214 |
| Ethylene | 166,224,385 | Note 1 | Note 1 | .... |
| $C_3$ hydrocarbons | 394,620,200 | Note 1 | Note 1 | .... |
| $C_4$ hydrocarbons | 668,496,079 | Note 1 | Note 1 | .... |
| All other (Note 2) | 201,225,630 | 969,551,338 | 13,520,739 | .014 |
| Total | 1,564,914,665 | 1,067,058,199 | 34,435,706 | 0.032 |

Note 1: Included only in totals to avoid disclosure of individual company operations.
Note 2: Represents data for benzene, xylene and other "crudes" from petroleum and hydrocarbons, but not toluene.

TABLE 2—U. S. Production and Sales of Synthetic Rubber, 1943

| Products | Production 1000 lbs | Sales[1] | | |
|---|---|---|---|---|
| | | Quantity, 1000 lbs | Value, $1000 | Unit Value Per lb, $ |
| (A) Cyclic (coal-tar): | | | | |
| Polybutadiene-styrene (Buna S type)[2] | 413,908 | 403,408 | 74,791 | $0.18 |
| (B) Noncyclic (non-coal-tar): | | | | |
| Polyisobutylene-isoprene (Butyl type)[3] | 3,074 | 1,949 | 2,385 | 1.22 |
| Polyisobutylene[3] | 914 | 312 | 441 | 1.41 |
| Polychloroprene (Neoprene type) | 75,720 | 72,381 | 36,855 | .51 |
| Polybutadiene-acrylonitrile (Buna N type)[4] | 32,450 | 32,200 | 17,462 | .54 |
| Polyalkylene-sulfide (Thiokol type)[3] | 1,680 | 1,682 | 841 | .50 |
| Polyvinyl alcohol-butyraldehyde[5] | 6,419 | 6,349 | 4,349 | .68 |
| All other[6] | 38,994 | 37,288 | 19,871 | .53 |
| Total, non-cyclic | 159,251 | 152,161 | 82,204 | .54 |

[1]Quantity of sales in government-owned plants is calculated from production in 1943 and stocks on hand December 31, 1942, and 1943. Value of sales in government plants represents value calculated from estimated quantity of sales and the average book value per pound for 1943 as supplied by the Rubber Reserve Co.

[2]United States and Canada.

[3]Government plants only.

[4]Data for private plants only. Statistics for Thiokol VA (a Buna-N type rubber) are combined with those shown under "All other" to avoid disclosure of the operations of individual companies.

[5]Private plants only.

[6]Under "all other" are given data for some of the plastics materials reported elsewhere also which have been converted by plasticizing into elastomers, such as polyvinyl chloride-acetate copolymers, polyvinyl-acetate, polyvinyl-alcohol, and polyethylene. Statistics are also included for polyisobutylene, polyalkylene-sulfide, polymerized rubber chloride and hydrochloride, Thiokol A, FA and VA produced in private plants. Data on individual products are confidential as their publication would reveal the operations of individual companies.

# Patent Trends in Petroleum Refining

*By Peter J. Gaylor*

### Polymers and Copolymers

In the plastics field, particularly in emulsion copolymerization of monomers, certain regulating or controlling agents have been added as, for example, carbon tetrachloride and hexachlorethane. The action of these regulators appears to be in inhibiting branching and cross-linking, thereby making possible higher yields of the desired copolymer. In many instances dealing with butadiene polymerization, the yield of polymer is actually decreased when compared to the yield obtained when no regulator is employed. Even though in some cases higher yields were found possible it is claimed that the product obtained does not have the required plasticity upon compounding and vulcanization.

The DuPont Co. (U. S. 2,388,167) has found that when regulators of the type of alpha-beta unsaturated aliphatic aldehydes are employed, higher yields of desired polymer are obtained than total polymer when no regulator is used. Furthermore, the product, upon compounding and vulcanization, gives a flexible rubber having the desirable degree of softness and tackiness.

Fig. 1 shows results obtained in the use of various regulating agents during emulsion copolymerization of 55% butadiene-1,3, 25% styrene, 20% of a mixture of 2-methyl pentadiene-1,3 and 4-methyl pentadiene-1,3, Ivory soap, sodium perborate catalyst and about 1% $Na_3PO_4 \cdot 12H_2O$ buffer. It will be observed that methacrolein gives greater yields of copolymer (after 20 hrs.) than any of the other regulators tried. It is employed in amounts of 0.1-1% of the weight of monomers in the emulsion.

Although it is generally believed that only conjugated diolefins will undergo copolymerization to high molecular weight products, a Jasco patent (U. S. 2,384,975) shows this is not so. It has been found that isobutylene will copolymerize with 2-methyl hexadiene-1,5 having the formula:

$$H_2C{:}C(CH_3)-CH_2-CH_2-CH{:}CH_2$$

Apparently, the active group in this case is the tertiary radical $CH_2{:}(C-R)-R$. Polymerization was conducted at —78°C. with $AlCl_3$ catalyst dissolved in methyl chloride. The products ranged in molecular weight ranges of 23,000 to 56,000, and pure gum cures showed 60 lb. tensile strengths up to 2270 psi and 60 lb elongation up to 1025%.

A convenient method for polymerizing ethenoid monomers of the type of vinyl acetate, methyl methacrylate, styrene, etc. consists in employing granular polymerization, in which the monomer is suspended in the form of droplets in a non-solvent such as water, together with a polymerization catalyst and dispersing agent. The mixture is heated in a vessel provided with an agitator.

DuPont contends that this process usually results in the formation of clusters of the globules of resin which impair operation of the agitator and require processing to wash out and remove clustered material. Better results are obtained (U. S. 2,383,069) by refluxing the mixture in a vessel provided with a cooling jacket and reflux condenser so that cool reflux may be returned into the vessel and thus, with the cooling of the vessel, control the rate of polymerization.

In Fig. 2, reaction begins at point A and, if the conventional method is employed, it progresses exothermically along curve AB, a condition conducive to cluster-formation. By proper cooling control, a desirable product is obtained. If cooling is applied too early, as in RS, very little reaction takes place. If it is applied too late, as in MN, some cluster formation has already taken place. The optimum point, in the case illustrated, is F. If cooling is applied here for too long a period, as in FGP, then the reaction is soon stopped. However, by controlled alternate cooling and allowing of heat to build up, polymerization will continue at an optimum rate FK until no more monomer is left, and the temperature then falls as in L.

Pittsburgh Plate Glass Co. has obtained U. S. 2,387,895 in which it describes some interesting copolymers of fatty oils with diolefins or their lower polymers. Some examples of charges

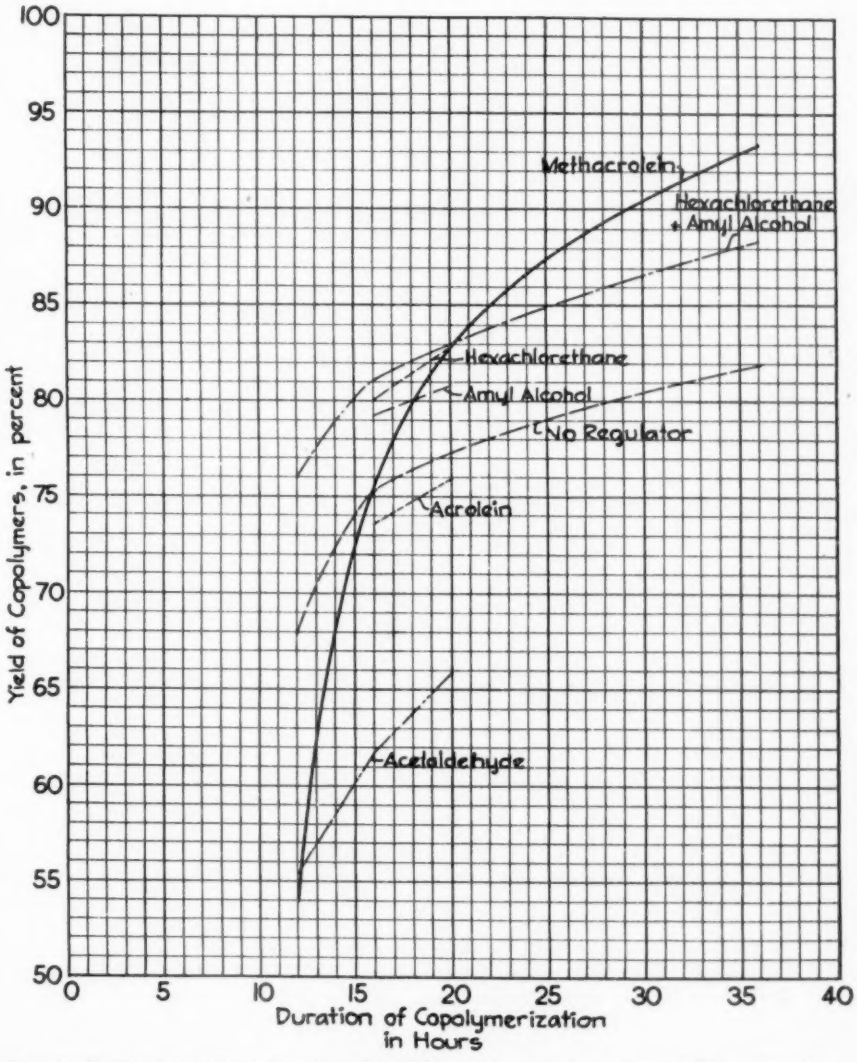



**Fig. 1—Action of duPont-developed regulators for use in polymerization reactions. It is claimed that these regulators give higher yields of the desired polymer, without decreasing the quality of the product**

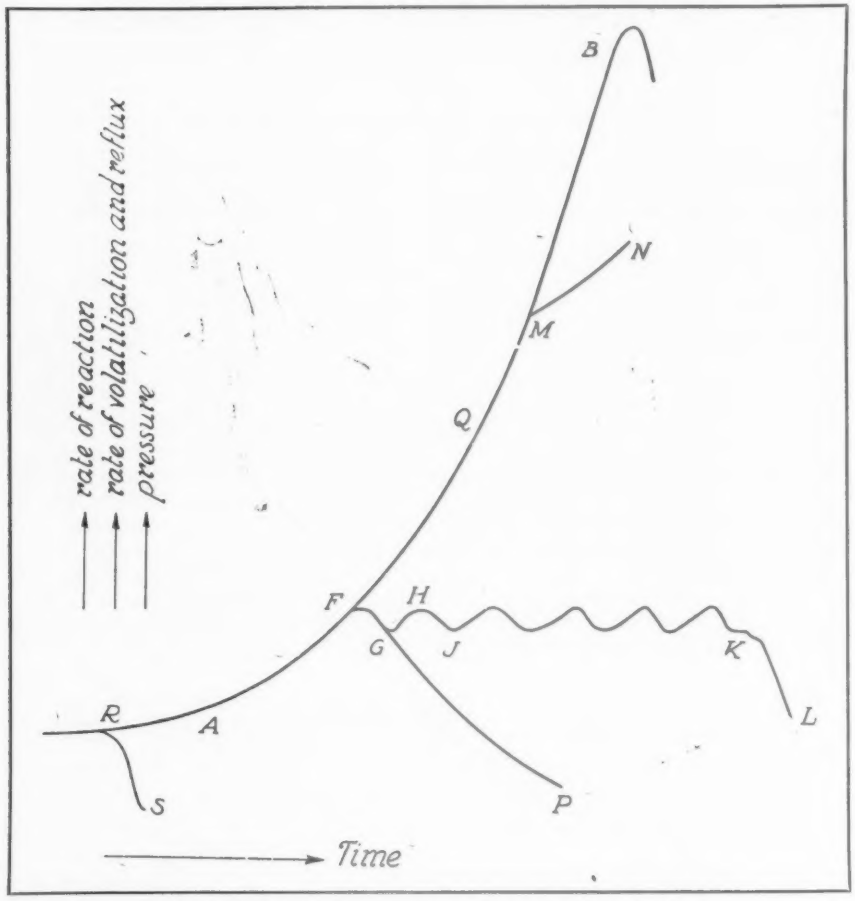



Fig. 2—Control of temperature during polymerization

employed are: 6 parts unbodied alkali-refined linseed oil and 4 parts dicyclopentadiene; equal parts of alkali refined medium bodied linseed oil and cyclopentadiene; and tung oil (10 parts), linseed oil (3 parts), and dicyclopentadiene (1 part). The reaction is carried out above 200° C.

Some of the copolymers are brittle and resemble varnish gums, while others are rapid drying liquids which may be considered synthetic substitutes for China wood oil for many applications.

## Sulfonic Acids

The fact that sulfuric acid reacts with some hydrocarbons is well known, and both "mahogany" and "green" sulfonic acids are formed during white oil production, presumably through interaction of the strong acid with cyclic hydrocarbons. However, very little information is available on reaction of sulfuric acid with saturated paraffins. Burkhardt (J.C.S., 10/30/45, p. 2387) disclosed the reaction of $SO_3$ with hexane, cyclohexane and methyl cyclohexane with 35-65% fuming acid at 0-10° C. for 4-5 hrs. claiming complete reaction upon stirring. His products were sulfate-sulfonates, disulfonates and monosulfonates (upon neutralization). The product obtained with hexane contained OH groups.

One of DuPont's patents (U. S. 2,383,-752) describes the reaction of light paraffins with $SO_3$ in vapor phase to yield polyhydroxy sulfonic acids. In the case of isobutane, a mixture of two polyhydroxy sulfonic acids was obtained in the ratio 27% $C_4H_{10}SO_6$ and 73% $C_4H_{10}S_2O_8$, while with *n*-butane, the barium salts were found to contain 31% $C_4H_8SO_7$ and 69% $C_4H_{10}S_2O_8$.

## Selected Patents of the Month

U.S. 2,389,144 (Shell)—Extracting olefins with aliphatic acid anhydride.
U.S. 2,389,176 (Standard Oil Dev. Co.)—Olefin-free aviation gasoline.
U.S. 2,389,205 (Standard Oil Dev. Co.)—Diolefins from olefins and aldehydes.
U.S. 2,389,215 (Standard Oil Dev. Co.)—Dehydrogenation.
U.S. 2,389,227 (Standard Oil Dev. Co.)—Pneumatic tool lubricant.
U.S. 2,389,230-1 (Phillips Petroleum)—Diolefins from halides.
U.S. 2,389,236 (Standard Oil Indiana)—Catalytic conversion.
U.S. 2,389,240 (Phillips Petroleum)—High V.I. viscous oil by polymerizing low olefins with Zr tetrahalide.
U.S. 2,389,250 (Socony)—Isomerization.
U.S. 2,389,251 (United Gas Improvement Co.)—Organometallics for removing impurities from unsaturated hydrocarbons.
U.S. 2,389,342 (Phillips Petroleum)—Catalytic dehydrogenation.
U.S. 2,389,406 (Universal Oil Products)—Dehydrogenation-isomerization catalyst.
U.S. 2,389,444 (Universal Oil Products)—Styrene.
U.S. 2,389,445 (Universal Oil Products)—Ethyl benzene.
U.S. 2,389,453 (Sun Oil)—Cycloaliphatic amides.
U.S. 2,389,457 (Universal Oil Products)—Hydrogen halide purification.
U.S. 2,389,493 (Socony)—Hydrocarbon conversion.
U.S. 2,389,513 (Texas)—Lubricant containing anacardic phosphate ester.
U.S. 2,389,523 (California Research Corp.)—BaCaMg stearate grease.
U.S. 2,389,527 (Texas)—Additive oil.
U.S. 2,389,550 (Shell)—Catalytic alkylation.
U.S. 2,389,576 (Monsanto)—Esters of diolefinic phosphoric acids.
Can. 431,058 (Pacific Lumber)—Redwood tar antioxidant.
Can. 431,071 (Shell)—Corrosion testing element.
Can. 431,072 (Shell)—Insecticide.
U.S. 2,387,228 (Phillips Petroleum)—Purifying $AlCl_3$ from $FeCl_3$.
U.S. 2,387,237 (U.G.I.)—Catalytic polymers from high boiling unsaturates of petroleum pyrolysis.
U.S. 2,387,250 (Petrolite)—Purifying low water content mineral oils.
U.S. 2,387,259 (United Gas Improvement Co.)—Polymerizing unsaturates from petroleum pyrolysis.
U.S. 2,387,267 (Houdry)—Operation of catalytic plants.
U.S. 2,387,279 & 403 (Socony)—Dinitro paraffin diesel dope.
U.S. 2,387,284 (Dow)—Inhibitor for $CCl_4$ corrosion.
U.S. 2,387,309 (Standard Oil Dev. Co.)—Catalytic cracking-alkylation combination.
U.S. 2,387,318 (Phillips Petroleum—$P_2O_5$ polymerization catalyst.
U.S. 2,387,323 (Standard Oil Indiana)—Antirust containing amidoxime.
U.S. 2,387,378 (Phillips Petroleum)—Catalytic cracking.
U.S. 2,387,454 (Socony)—Porous glass reactor.
U.S. 2,387,477 (Universal Oil Products)—Catalytic cracking.
U.S. 2,387,501 (duPont)—Hydrocarbon oil containing oil soluble polymeric N-aliphatic acrylamide.
U.S. 2,387,508 (Texas)—Hydrocarbon conversion with Al halide.
U.S. 2,387,514 (Standard Catalytic)—Cellular asphaltic insulation.
U.S. 2,387,517-8 (Jasco)—Copolymerization catalyst and stabilized polymer.
U.S. 2,387,519 (Standard Oil Dev. Co.)—Sulfuric acid recovery from sludge.
U.S. 2,387,524 (Standard Oil Dev. Co.)—Dehydrogenation.
U.S. 2,387,537-8 (Gulf)—Fatty and dicyclohexyl amine salts of alkyl phosphoric acids.
U.S. 2,387,541 (Standard Oil Dev. Co.)—Isomerization.

GULF

## Manufacturers of Quality Petroleum Products

**DIVISION SALES OFFICES**

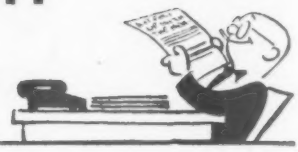
Boston
New York
Philadelphia
Pittsburgh
Atlanta
New Orleans
Houston
Louisville
Toledo

**REFINERIES**

New York
Philadelphia
Pittsburgh
Toledo
Cincinnati
Port Arthur
Fort Worth
Sweetwater

# Keeping Up With the News

*By N.P.N. Special Writer*



**Numerous recent happenings in diverse fields, seemingly unrelated, are shown, in this technical-economic review, to be associated with and of importance to the petroleum industry.**

**Underground storage of petroleum, while not a new proposal, has again become of significance in relation to national security and international demand. Synthine developments continue to attract attention, with commercialization almost a reality. Petroleum butadiene will henceforth be the chief raw material for GR-S, along with styrene.**

**A new method of nitrogen fixation will soon reach the pilot-plant stage and will perhaps provide natural gas-derived ammonia with some competition. It is interesting to note that even the coal-engrossed Pennsylvania railroad has ordered several Diesel locomotives. Silicone lubricants, while interesting and important, are likely to prove too expensive for large scale use, at least for the present.**

## *Underground Storage*

As reported in a recent issue of NATIONAL PETROLEUM NEWS(1), Secretary of the Interior Ickes continues to give attention to the possibility of importing foreign crudes and storing them in depleted U. S. fields. This idea has many ramifications, domestic and international, but it is interesting to learn, from other sources, that it is not technically impossible. Accomplishment would be difficult, however, and there is no assurance that the desired goal—ready availability of oil in times of national emergency—would thus be attained.

Depleted or semi-depleted oil fields are not the equivalent of storage tanks, from which oil can be obtained at any desired rate simply by adjustment of pumping facilities, with the certainty that the total volume obtained will be the same regardless of rate. To begin with, only those extensive fields which have sands of reasonable permeability can be considered at all, and even these would require extended periods for insertion and withdrawal.

Technically, it would be no very difficult task, for the experienced physical geologist, to select a number of domestic fields which might prove interesting, at least for experimentation. These fields, social economics aside, would not have to be completely exhausted; in fact, those producing fields from which large quantities of oil have been obtained at reasonable cost would seem to be most economic for reinjection (underground conditions being right), since there would then be reasonable assurance of regaining injected oil when desired.

The implications of such a program are too complex for more than brief discussion here. The domestic petroleum industry might be seriously affected by the presence of huge, government-owned reserves. It would be no easy task to arrive at a fair price for partially or semi-depleted fields. Foreign repercussions might be severe if and when the desired reserve was obtained, since productive capacity outside this country would obviously have to be used at a high (or increased) level if sizeable reserves are to be acquired in a reasonable period of time.

In addition, socialistic elements might look askance at the importation of oil simply for the purpose of pumping it into the ground while oil in other parts of the country was being pumped from the ground, and might agitate, increasingly, for government ownership of domestic reserves so that production from these might be frozen and imports used instead. Such an argument might hold attraction to even more temperate elements, who might not understand that domestic reserves have been maintained and increased only because there has been an incentive for exploration which could hardly exist under government ownership.

As to foreign reserves, however, there is no question that they would be adequate for any such program. Actual statistics mean little, since even sketchy exploration has already indicated "proved reserves" of over 31 billion barrels outside this country. Over half of this figure represents oil in the Near and Middle East, and other reasonable estimates indicate that this figure may actually exceed 27 billion barrels; one source believes that the ultimate reserve in this region will total more than 100 billion barrels! South American reserves are also extensive.

A cursory survey would seem to indicate that many of the foreign crudes are not comparable in quality and product distribution to domestic oils, but no very great debit in refinery realization seems indicated. Recently-published figures (quoted, without complete identification, "from the *Congressional Record*"), also, would seem to indicate that, profit considerations aside, oil from Middle East could easily compete with domestic oil (profit included) on an f.o.b. basis, both in New York and Los Angeles refineries. Such a comparison, of course, is hardly fair, and Middle East oil would certainly be noncompetitive at present Middle East sales prices, but the fact remains that huge quantities of foreign oil could be imported at prices very near to present levels (or even below them, perhaps).

Production economics do not always interest refiners and refinery technologists, but the implications of international oil activities on a governmental level can hardly be disregarded by any thinking member of the petroleum industry. It is by no means easy to see the solution to problems such as this one—often downright impossible, but it is certain that politicians will make the decisions unaided if petroleum interests cannot offer informed advice.

## *Synthine Developments*

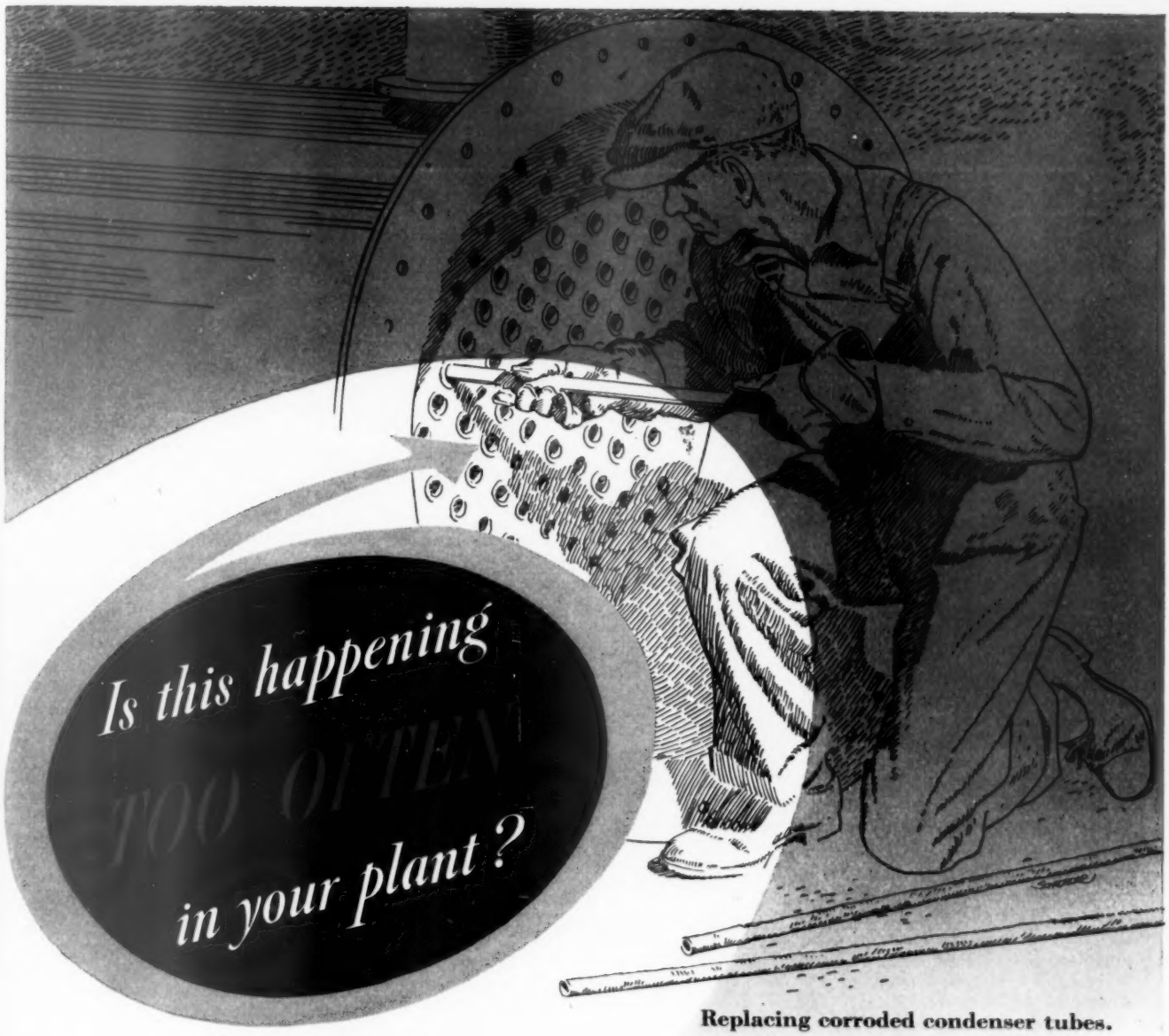
The flood of German technical data, obtained by Allied missions, has almost served to obscure, in recent months, the many domestic developments in the field of petroleum substitutes. In particular, there have been several recent informational releases which serve again to concentrate attention upon the Synthine (Fischer-Tropsch) process.

The first of these, an article in Collier's(2), gives more details on the Synthine plant to be built by Hydrocarbon Research, Inc., at Carthage, Texas(3). According to this source, the $15,000,000 plant will be designed to produce about 5,000 b/d of 80-octane gasoline, 1,000 b/d of Diesel oil, and

(1) Yocom, Herbert, *NATIONAL PETROLEUM NEWS* 37, No. 50, 8 (1945), "Ickes Still Considers Importing, Storing Foreign Crudes."

(2) Ratcliff, J. D., *Collier's* November 25, 1945, p. 26.

(3) Anon., *NATIONAL PETROLEUM NEWS, Technical Section*, 37, No. 36, R-744 (1945), "Keeping Up With News—Petroleum Substitutes."




Replacing corroded condenser tubes.

**Condenser Tubes of Alcoa Alclad Aluminum may be the answer to your corrosion problems**

The idea's not new. Condenser tubes of Alcoa Aluminum are already employed in all manner of processing plants. The aluminum safeguards product quality. And it offers high resistance to the attack of corrosive cooling waters and of materials being processed.

Now, a new development in tubing is offered —Alcoa Alclad—strong aluminum combined with a highly protective interior coating of aluminum. An even greater number of gases and liquids can be handled by aluminum condenser tubes than before.

Why not try aluminum tubes in one of your condensers? In addition to being long-lived, tubes of Alcoa Alclad are surprisingly low in first cost. See our nearest sales office or write ALUMINUM COMPANY OF AMERICA, 1869 Gulf Building, Pittsburgh 19, Penna.

**ALCOA** FIRST IN **ALUMINUM**

ALCOA ALUMINUM

about 200,000 pounds per day of crude alcohols.

Ground for this plant is expected to be broken in February, and completion is scheduled for "sometime in 1946." Some 65,000,000 cu. ft. of natural gas will be required per day (about 10,000 per bbl. of "oil"), along with 40,000,000 cu. ft. per day of oxygen.

The latter requirement is significant in that it confirms the statement that a partial oxidation process will be used to produce the required "synthesis gas," instead of the catalytic methane-steam (water gas) reaction. Success of the process is said to rest upon the fact that this oxygen will be provided for only five cents per thousand cubic feet. Power for the compressors will be obtained from use of the heat released by the exothermic synthesis reaction.

"Half a dozen oil companies" are said to be backing this venture, although only three were named in the earlier report[3]. P. C. Keith, president of Hydrocarbon Research, has estimated that if coal were substituted for natural gas, without further technical advances, gasoline so produced would cost about ten cents a gallon. This figure is in line with other recent estimates, some of which indicate a potential near-future cost of eight to nine cents per gallon.

G. G. Oberfell, vice president in charge of research and development of the Phillips Petroleum Co., is not as optimistic as some in regard to Synthine economics. In a recent speech before the Chicago Section of the American Institute of Mining and Metallurgical Engineers[3-a], Oberfell stated that, "on the basis of conservative published estimates, the synthesis process utilizing natural gas will not be able to compete with present refinery methods utilizing crude petroleum until the price of crude reaches about $1.75 to $2 per barrel. However, on the basis of experimental data not yet confirmed by large scale commercial operations, gas may be competitive with crude oil under special circumstances."

Such commercial operations are likely to be attempted in the near future, according to Oberfell, a fact confirmed above. Among pertinent figures upon which he based his conclusions are: (1) "for every cent of cost per 1000 cu. ft. of methane, with 50% of the fuel value converted to gasoline, the raw material cost alone will be ¼c per gallon of gasoline"; and (2) "with natural gas at 5c per 1000 cu. ft., its cost per barrel of gasoline produced (10,450 cu. ft. per bbl.) is approximately $0.52. To compare favorably with this cost, the price of coal (as a raw material) would have to be about $0.77 on the basis of 1,360 lbs. of coal per barrel of gasoline produced (a somewhat high figure considering potential developments). With natural gas at 10c per 1000 cu. ft., the equivalent price of coal would be $1.54 per ton." Parenthetical remarks are not Oberfell's.

Oberfell points out that it is theoretically possible to obtain about 6.5 gals. of gasoline per 1000 cu. ft. of methane, disregarding fuel requirements, and that this gasoline would have a fuel value of 75% of the original natural gas. Actually, in his quoted plant of "possible future design," he shows that, when 10,450 cu. ft. are required per barrel of gasoline, 104.5 therms are required per barrel of 50.5 therms, a conversion of 48.3%.

It is hard to keep abreast of Synthine developments in these days when each journal is filled with details of German research, plans of the Bureau of Mines for its (somewhat misnamed) "demonstration" program, and often-misquoted arguments on the economics and advisability of using natural gas for petroleum synthesis. Nevertheless, it is well worth surveying every new release in order to gain a better perspective of a process which, at present, is certainly the most promising method for providing petroleum substitutes.

(3-a) Oberfell, *NATIONAL PETROLEUM NEWS, Technical Section*, 38, No. 1, R-46 (1946) "Utilization of Natural Gas in the U. S." (This issue).

## Petroleum Butadiene

The Office of Rubber Reserve has recently amplified the information reported two months ago[4] on its synthetic rubber program. In regard to 1946, GR-S (Buna-S) production, all of the copolymer plants will remain in operation, but their capacity, on a three 40-hour shift per week basis, will be cut to approximately 580,000 long tons, part of this reduction being attributable to operating changes designed to yield a better product.

Butadiene for this capacity will be supplied entirely from petroleum plants, which will produce an estimated 413,000 short tons; alcohol-butadiene plants were expected to be shut down by the end of 1945. The latter action was taken for economic reasons; alcohol-butadiene has cost the government about 40c per pound, compared with 8-10c for petroleum.

The 8000 short tons per year, naphtha cracking plant of Jersey Standard, at Baton Rouge, will continue in production, however, since it also produces feed stocks for isoprene production and isobutylene for Butyl rubber synthesis. Similarly, the Southern California Gas Co.'s naphtha cracking plant at Los Angeles provides ethylene for styrene production in addition to its 30,000 tons of butadiene per year.

Some 900,000 long tons of elastomers may be consumed in 1946, of which about 300,000 tons may be natural rubber. This year may very well be the critical year for GR-S, since thereafter it will probably have to compete on equal terms with natural rubber (barring international or politico-domestic developments). Quality will certainly be improved, and prices materially lowered (since petroleum-butadiene should be available for less than ten cents per pound). For reasons of domestic security, an addition to the maintenance of a war-gained market for its products, the petroleum industry is definitely interested in the course of developments.

(4) Anon., *NATIONAL PETROLEUM NEWS, Technical Section*, 37, No. 45, R-933 (1945), "Keeping Up With the News—Synthetic Rubber."

## Nitrogen Fixation

A recent announcement[5] of some interest to the petroleum industry concerns a war-developed process for the direct combination of nitrogen and oxygen at 4,200°F., followed by rapid cooling to 580° F. Pilot plant experiments, soon to begin at the University of Wisconsin (where the process was developed under Dr. Farrington Daniels), will shortly determine the "engineering feasibility on a large scale, permitting accurate dollar estimates." A Chinese salt company is joint sponsor of the program, and the first commercial plant will probably be erected in China, "as the new method seems well adapted to small scale installation."

Several American companies are said to be negotiating for licenses, for nitric acid plants. Since the process does not produce ammonia as an intermediate, plants using it are not likely to compete with ammonia plants (large users of natural-gas-derived hydrogen) except for that portion of the ammonia market concerned with nitric acid synthesis, "usually less than a quarter" of production. Nevertheless, this new variation of nitrogen fixation, which takes place "in a furnace about as big as a silo and one-third as tall" is at least of technical interest, since nitrogen oxidation (usually by electrical means) has heretofore been quite costly.

## Diesel Locomotives

In connection with the recent discussion on Diesel oils, which appeared in the Oct., 1945, issue of this series[6], it is interesting to note that the Pennsylvania Railroad, despite its interest in coal (an important item of freight) and its consequent research

(5) Anon., *Business Week*, November 24, 1945, p. 56, "Cheap Nitrates."

(6) Anon., *NATIONAL PETROLEUM NEWS, Technical Section*, 37, No. 40, R-818 (1945), "Keeping Up With the News—Diesel Oils."

on coal-powered steam turbine and gas turbine locomotives, has recently purchased ten 6000-hp. Diesel-electrics from General Motors.

These engines, to be delivered this year, "will be used on runs outside the road's eastern electrified territory —possibly on the Broadway Limited and other high-speed passenger trains from Chicago and St. Louis to the East."(7) Naturally, this nod in the direction of Diesel potentialities is to be expected of any company which does not intend to blind itself to economics, but it is certainly significant to learn that "one of the country's major coal hauling lines" has confirmed these economics for itself.

### Silicone Lubricants

The recent paper on "Silcones as Lubricants" presented at the recent S.A.E. Fuels and Lubricants Meeting and printed, in large part, in the last technical issue of NATIONAL PETROLEUM NEWS(8), has served again to focus attention on these new lubricants and to cause speculation on their competition with petroleum products.

There is no doubt that their high resistance to temperature change, oxygen stability, and chemical inertness, combined with varying lubricating characteristics, render these silicone lubricants of considerable importance for many applications, but it is as specialty products that their competition will chiefly be felt.

Silicones are also used as resins and elastomers, for a variety of purposes, and the high costs involved in present methods of synthesis have not prevented the development of many important uses. Just how high are these prices may be judged by reference to another article on the subject(9); D. P. Thornton, Jr., in an inset in the first article(8), mentioned a price of $6.50 per pound.

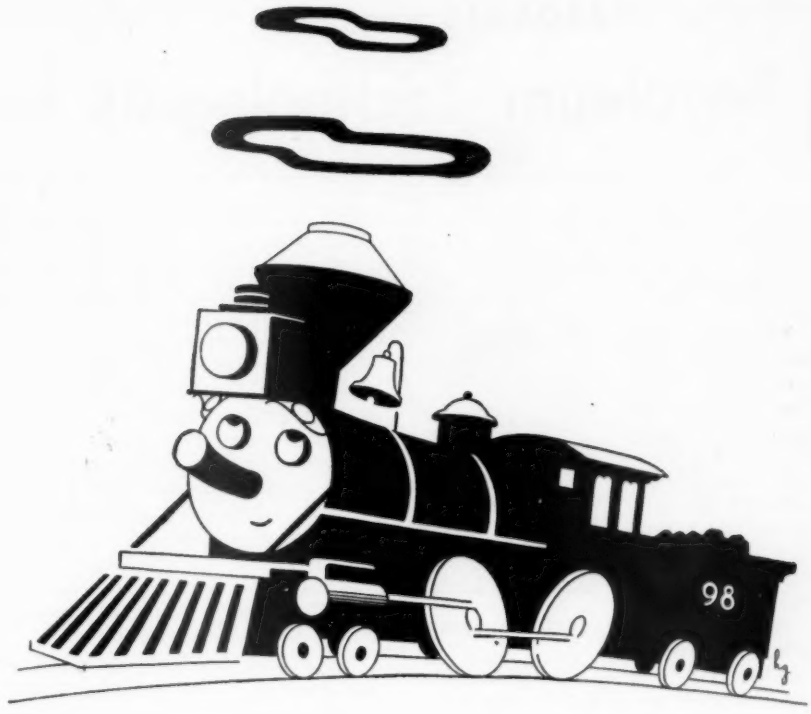
"Prices are still rather high. Resins cost $3 to $4 per pound; varnishes, $15 per gallon, on the basis of 50% solids. Silicone fluids are sold at about $6 per pound, or $48 per gallon. The silicone greases cost $6 to $7 per pound. Silicone rubber costs $3 to $4 per pound. The ceramic treating solution can be had for 38 to 48c per pound. These prices may be expected to decrease as facilities for production increase, and uses multiply. They have already declined about 20%.

"The deciding factor in the use of the silicones in most instances is the fact that they can do things not possible with materials now available."

(7) Anon., *Business Week*, November 17, 1945, p. 26, "Diesel Overture."

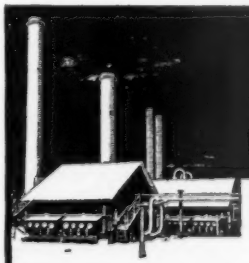
(8) Kauppi, T. A., and Pederson, W. W., *NATIONAL PETROLEUM NEWS, Technical Section*, 37, No. 49, R-944 (1945).

(9) Knight, H. A., Materials and Methods, October, 1945, p. 1069, "The Silicones—Truly New Material."


**THIS "LATEST MODEL" LOCOMOTIVE (vintage 1890) made its runs in "record time". But you can't imagine it pulling a streamlined train of 1946.**

**The record of refinery production, too, has outgrown any but the most modern equipment. Modernizing existing heaters is an Alcorn speciality. Many such Alcorn-treated heaters are now in successful operation in all types of service. Bring your heater equipment up to record production — bring your heater problems to Alcorn. Consult them today.**



ALCORN
Combustion Company
SCHAFF BUILDING, PHILADELPHIA
Los Angeles • Houston • San Francisco • Tulsa

PERSONALS

# Petroleum Technologists in the Headlines

**M. H. Arveson** has been named senior technologist in the recently formed chemical products department of the Standard Oil Co. Ind.

Mr. Arveson

Mr. Arveson has been with the company since 1927, first as a research chemist and group leader at the Whiting refinery laboratories and later as a member of the development and patent department.

**Dr. E. L. D'Ouville,** formerly a member of the research department, has returned to Standard of Ind. after several years with the Mellon Institute, and will take over Mr. Arveson's duties in the development and patent department.

o o o

A Petroleum Chemicals Division has been established by E. I. duPont de Nemours and Co. with the consolidation of two divisions of its organic chemicals department into a single unit.

The merger combined the former alcohol and tetraethyl lead divisions, operating plants at Deepwater, N. J., and Baton Rouge, La.

**J. L. Stecher,** who was manager of the tetraethyl lead division, was appointed division manger, while **William F. Krug, Jr.,** formerly manager of the alcohol division, was named assistant manager of the new unit.

Other appointments include: **J. R. Sabina,** technical director, and **Dr. J. M. Herndon,** division production manager.

o o o

**Frank E. Johnson** has left the Phillips Petroleum Co. to join the process engineering division of the Cities Service Refining Corp., Lake Charles, La.

o o o

Changes announced by Shell Oil Co. include the return of **Lieut.-Col. John L. Miller** as superintendent of the Houston refinery, after more than three years in the service. Acting superintendent **Paul E. Hurley** takes over as manager of the Norco refinery. Both men have been with Shell since 1920. Hurley began as a gauger at the company's Wood River refinery. He was later head stillman at the old Arkansas City refinery and in 1929 was made assistant superintendent at the same plant. He was made superintendent at Norco in 1935. Lieutenant-Colonel Miller also started as a gauger at Wood River; he became assistant head stillman, assistant superintendent, and (in 1935) superintendent at the old East Chicago refinery, and in 1937 moved on to the Houston refinery in the same capacity. He entered the Army in April, 1942.

**Horace D. Dale,** who has been with Shell since 1924, has been appointed assistant to the vice president of the manufacturing department. During the first eight years of his employ, Mr. Dale progressed from a gauger at the Wood River refinery through various positions to that of assistant superintendent in charge of operations, topping and cracking. In 1941 he was made refinery superintendent and in 1944 moved to the Shell's head office as manager of the operations department.

Succeeding Mr. Dale as manager of the operations department in New York is **William B. Stewart.** Mr. Stewart has been with the company since 1926, first as technical assistant at the Wilmington, Calif. refinery, then in the manufacturing department at San Francisco, and in 1935 as assistant to the refinery manager at Martinez. Since 1943, he has been manager of the products manufacturing department in New York.

o o o

**F. H. Holmes,** former superintendent of The Texas Co.'s refinery at Lockport, Ill., has been transferred to the Port Arthur, Texas, plant as general superintendent. A native of Port Arthur, Mr. Holmes has been with the company since 1927 and has been in the refining division since 1930. He has held supervisory positions here and abroad since 1932.

**D. P. Bailey,** general superintendent at Port Arthur, has been made assistant works manager, F. L. Wallace remaining as works manager. Mr. Bailey has been with the company since 1927 and has had supervisory experience in the refining department in this country and in France.

**L. V. Phillips,** superintendent at the Lawrenceville refinery, has been transferred to Lockport to take the place formerly held by Mr. Holmes. He was assistant to the general superintendent at Port Arthur before going to Lawrenceville.

**F. M. Dawson** takes Mr. Phillips' place as superintendent at Lawrenceville. He has been with the company since 1928 and has held a number of supervisory posts.

o o o

Personnel changes have been announced at three Pure Oil Co. refineries. **O. B. Wendeln,** superintendent at Midland, Mich., will go to Chicago headquarters as a member of the refinery control board. Replacing him at Midland is **H. F. Smith,** formerly superintendent at Toledo, who is returning from a leave of absence. **Dale Miller,** acting assistant superintendent at Toledo, has gone to the Heath refinery at Newark, O., as assistant superintendent.

o o o

**Robert V. Kerley** has been appointed director of aeronautical research for Ethyl Corp., succeeding **S. D. Herom,** who will remain with the company as a special consultant. Mr. Kerley was formerly a civilian engineer with the engineering division of the Army Air Force at Wright field and since 1936 has been chief of the fuel and lubricating branch, power plant laboratories of the Air Technical Command.

o o o

**W. O. Wilson** has succeeded **C. W. Smith** as manager of the Safety Department of Standard Oil Co. of Indiana. Mr. Smith recently retired. Mr. Wilson, formerly assistant manager of safety, joined the company in 1925 and has been actively engaged in safety work since 1927.

o o o

**William Irwin** has been appointed assistant resident manager of the Ethyl Corp. manufacturing plant in Baton Rouge, La.

Mr. Irwin

Mr. Irwin comes to Ethyl after twelve years with E. I. du Pont de Nemours and Co. As district superintendent of general construction for du Pont from 1941 to 1944, he supervised construction of war plants and devoted full time to the Oak Ridge, Tenn. construction project from June 1943 until the plant went into operation late in the same year.

o o o

**Dr. N. L. Anfilogoff,** formerly head of the European Technical Service of The Texas Co., has recently joined the staff of Berry Wiggins & Co., Ltd., London and has now been appointed a director of the firm.

o o o

**Glenn G. Bartle,** natural gas geologist and former dean of liberal arts in the University of Kansas City, has joined the staff of E. Holley Poe and Associates, natural gas consultants, New York. Dr. Bartle was recently released from the Navy after serving as commanding officer of the V-12 unit at Swarthmore College. Previously he organized the courses of instruction in the Navy's anti-aircraft schools in this country.

**P. S. Macgruder**, who was manager of the Gas Dept. of the General Petroleum Corporation and who recently became assistant manager of manufacturing, has been made director of the corporation and manager of manufacturing. He succeeds the late **R. C. Wheeler.**

**H. L. Eggleston**, who was with the Gilmore Oil Company, has been named manager of the Gas Department and will continue to manage the manufacturing activities of the Gilmore Road Oil and Asphalt Company. **M. W. Kibre,** who was superintendent of the Gas Department at Vernon, has been named assistant manager of the Gas Department. **H. A. Sting** has been promoted from gas engineer at Vernon to superintendent of the Gas Department, Southern Division, with headquarters at Vernon. **A. C. Lules,** chemist at the Santa Fe Springs gas laboratory, has been appointed gas engineer in charge of the "Springs" Gas Laboratory.

° ° °

**H. G. M. Fischer** and **Edwin J. Gohr,** formerly manager and associate manager of divisions of the Esso Laboratories, have been appointed assistant managers of the research and development department of Standard Oil Development Co.

They will share responsibility for new and improved processes in the petroleum field and undertake administrative duties within the company.

Five other promotions were also made in the Development Co. **A. P. Hewlett** was made manager of the process division of the Esso Laboratories, succeeding Mr. Fischer; **F. W. Schumacher** and **R. M. Shepardson** were appointed assistant managers; **B. C. Belden** succeeds Mr. Schumacher as laboratory director; **C. W. Tyson** replaces Mr. Gohr as associate manager of the development division of the Esso Laboratories.

° ° °

**D. L. Hooker** has been appointed vice chairman of the manufacturing committee of the Socony-Vacuum Oil Co., Inc. **George S. Dunham,** manager of the refinery engineering department, will represent the midwest refineries on the committee.

Other recent appointments include those of **J. B. Middleton** to the manufacturing committee as manager of foreign refinery operations and **S. D. Dalton** as chief refinery engineer.

° ° °

**W. F. Stroud** has been named plant manager of the Atlantic Refining Co.'s Philadelphia refinery, succeeding **Howard M. Nichols,** who retired. **D. T. Shaw** has been appointed assistant plant manager.

° ° °

**R. D. Gibbs** has been appointed vice president of Union Oil Co. of California, after 27 years of service with the company. Reporting to him are the marine, pipeline and communications, automotive and traffic departments. He is also responsible for crude oil purchases, supply of petroleum products and crude oil and product exchanges.

Mr. Gibbs started with Union Oil Co. when the Los Angeles refinery was being built, as a laborer. He later worked in the refinery as a treater, machinist helper and absorption plant operator. He worked successively in the research department, Rosecrans absorption plant, and in gas operations, becoming manager of gas operations in 1934. When the gas and field departments were combined in 1941, he was selected to head them as manager of field operations. He recently was assistant to the executive vice president.

° ° °

**B. H. Weil** is chief information specialist of the State Engineering Experiment Station, Georgia School of Technology, Atlanta, having recently assumed that position after leaving the Chemistry Division of Gulf Research & Development Co., where he held a similar position for several years. He is graduate in chemical engineering of the University of Missouri and received his M.S. degree at University of Wisconsin.

Mr. Weil

° ° °

**R. M. Deanesley**, recently with M. W. Kellogg Co., and Kellex Corp., has joined the research staff of Universal Oil Products Co. to be in charge of a new department being established in the company's Riverside laboratories.

While with the Kellex Corp., he did important work in connection with the separation of U-235 by gaseous diffusion. Previous to that he was with Shell Development Co. for 15 years.

° ° °

**John F. Dodge**, petroleum engineering consultant and since 1929 head of the division of petroleum engineering at University of Southern California has joined Pantepec Oil Co. of Venezuela, C. A. as vice president and manager, with headquarters in Caracas. He will retain his association with the university. For years Mr. Dodge was petroleum engineer with Kern Trading & Oil Co., Pacific Oil Co., and Standard Oil Co. of California. He has visited and studied oil fields of Burma, Sumatra, Java, and Venezuela, besides many in North America.

° ° °

**S. G. Lansing** has been appointed manager of the Socony Paint Products Division and president of the Socony Paint Products Co.

Mr. Lansing, who was assistant general manager of the Socony Paint Products Division and vice president of the Socony Paint Products Co., succeeds **C. F. Beatty** who has become associated with **Vice President Walter F. Faust** in the domestic marketing activities for which Mr. Faust is responsible.

Mr. Lansing was graduated from Cornell University in 1916. He served in the Navy during World War I, advancing from seaman first class to lieutenant junior grade. For many years Mr. Lansing was manager of Marine Sales, Socony Paint Products Division, becoming assistant general manager and vice president early this year.

° ° °

## TECHNICAL MEETINGS FOR OIL MEN

**FEBRUARY**

4-8 American Society for Metals, annual convention, Statler Hotel, Cleveland.
4-8 American Welding Society, national meeting, Hotel Cleveland, Cleveland.
4-8 American Institute of Mining and Metallurgical Engineers, Iron and Steel and Institute of metals division, Statler Hotel, Cleveland.
25-Mar. 1 American Society for Testing Materials, spring meeting, Pittsburgh.
25-Mar. 2 International Exposition, Grand Central Palace, New York.

**APRIL**

18-19 National Petroleum Association, Semi-annual meeting, Hotel Cleveland, Cleveland.
17-19 Natural Gasoline Association of America, annual meeting, Baker Hotel, Dallas.
8-12 American Chemical Society, 109th meeting, Atlantic City.

**MAY**

7-8-9 National Association of Corrosion Engineers, annual meeting, Municipal Auditorium, Kansas City.
17-24 International Petroleum Exposition, Tulsa.

**JUNE**

24-28 American Society for Testing Materials, annual meeting, Buffalo.

## ADVERTISERS' INDEX

*This index is published as a convenience to the reader. Every care is taken to make it accurate but National Petroleum News assumes no responsibility for errors or omissions.*


Alcorn Combustion Co. ..... R-77
Aluminum Company of America ..... R-75
American Cyanamid & Chemical Corp. ... R-15
American Meter Co. ..... R-54-R-55
Attapulgus Clay Co. (Porocel) ..... R-21
Attapulgus Clay Co. (Driocel) ..... R-32
Badger & Sons Co., E. B. ..... R-40-R-41
DuPont de Nemours & Co., Inc., E. I. .. R-52
Ethyl Corp. ..... R-2
General Chemical Co. ..... Inside Back Cover
Gulf Oil Corp. ..... R-73
Harshaw Chemical Co. ..... R-63
Hooker Electrochemical Co. ..... R-39
Houdry Process Corp. ..... R-45
Hudson Engineering Corp. Inside Front Cover
Jones & Laughlin Supply Co. ..... R-26
McKee & Co., Arthur G. ..... R-59
National Petroleum News ..... R-62-R-69
Powell Co., Wm. ..... R-23
Sun Shipbuilding & Dry Dock Corp. ... R-19
Universal Oil Products Co. ..... R-34-R-35
Wyatt Metal & Boiler Works ..... Outside Back Cover

# WIDENING HORIZONS

**Views on Personnel, Management and Economic as Well as Technological Developments in Petroleum Refining and Natural Gas Processing: Comment from Readers Is Invited**

## *Kilgore Presents a New Draft Of His Research Program Bill*

SENATOR Kilgore has withdrawn his bill (S. 1297) coordinating research in the public interest through a federal National Science Foundation. S. 1297 was introduced last summer in Congress concurrently with the Magnuson bill, which was based on the report in support of a national research program made by Dr. Vannevar Bush, director of the Office of Scientific Research and Development.

In place of this bill Senator Kilgore has prepared a new draft, which he terms the "National Science Foundation Act of 1945". This bill, it is stated, is based on the hearings held in October before a Congressional sub-committee on the proposal for coordinating research nation-wide under control of a federal agency. It is at least inferred that it incorporates features of both the Kilgore and Magnuson bills.

However, the new draft in two principal features is the same in substance as the Kilgore bill introduced last summer. It is in these two features that the Kilgore proposal differs mainly from the plan supported by Dr. Bush and his committee of some 200 nationally known scientists.

First, under the Kilgore plan the research program would be directly administered by and controlled by government officials subject to the usual political influences, rather than by expert scientists allowed freedom and initiative and reporting to the President. Final responsibility for the direction of the research program, in the Kilgore proposal, is placed on full-time government officials, appointed by the President and confirmed by the Senate. The latest Kilgore report "rejects emphatically the principle of vesting the powers of the Foundation (supervising agency) in a board of non-compensated members as was recommended by certain witnesses."

The chief point of difference between the Kilgore and the Bush research program, however, which is continued in the new proposed draft of the former bill, pertains to the disposition of patents arising from research projects in the program. The new Kilgore draft adheres to the proposal that patents and discoveries arising from work financed in any part by the government should be "freely dedicated to the government."

The new Kilgore draft does make an exception to this general policy in that it gives the head of any government agency financing or directing federally financed research projects the authority to provide for the retention of patent rights by the inventor or the institution for which he is working. However, the disposition in the individual case is entirely with the government agency.

It is unfortunate that the plans for the coordination of research under the federal government for the public defense and in the public interest should be beclouded by the question of the revision of our patent system. The Bush program wisely accepts the patent situation as it finds it and leaves the federal directing agency free to arrange with the institution conducting the research project as to the patent rights to inventions and discoveries.

At the hearings held in October official Washington turned out in force in support of the Kilgore proposal. It seems certain that some form of a program for coordinating research in the interests of national defense and the public welfare will be enacted into law. Oil industry technologists who favor placing its control and supervision in the hands of the nation's scientists rather than its politicians should let themselves be heard from in the matter.

## *Postwar Competitive Era Brings New Plant Operating Problems*

OPERATION of petroleum refineries in the competitive postwar era has brought to light some new problems, for the most part having to do with the application in the plants of the technological improvements which developed during the war. These improvements have taken place not only in the refining processes themselves but also in many other lines which affect the materials used in the refineries and in the techniques in many of the mechanical crafts.

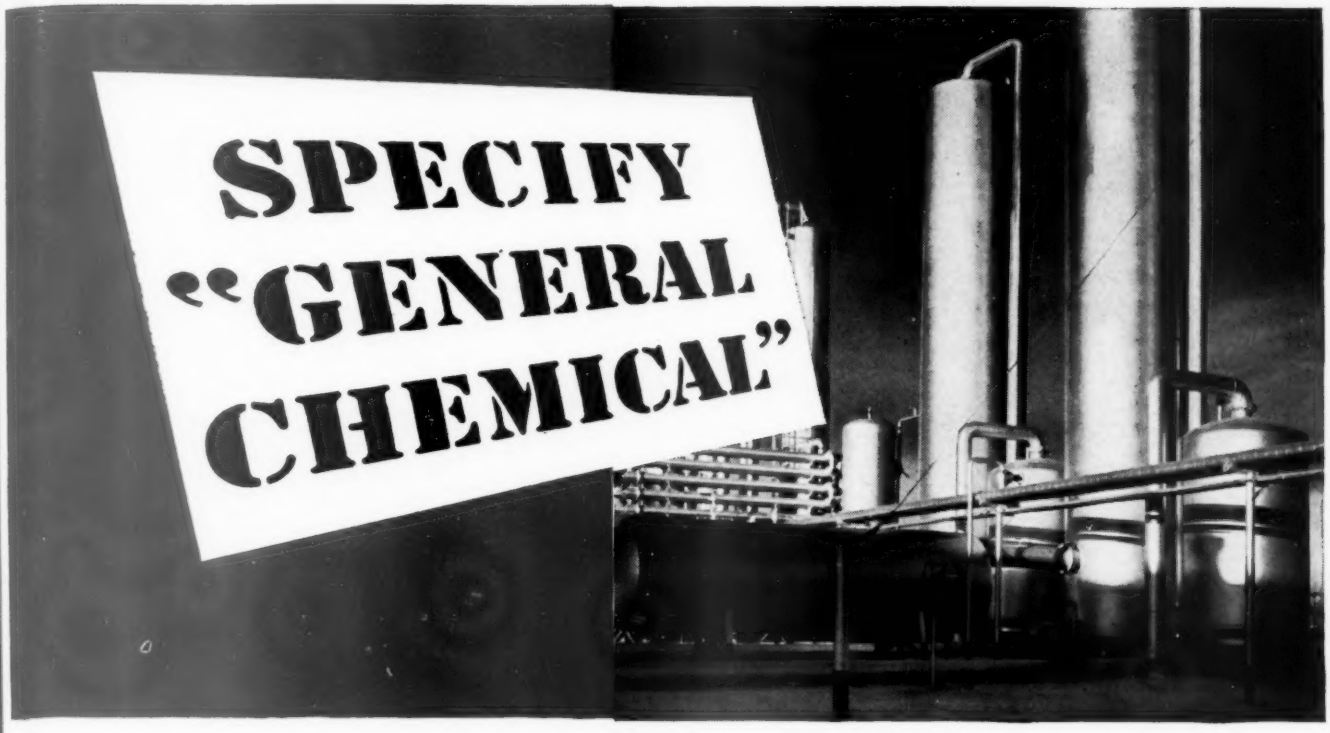
To expedite putting into effect in plant practice the improvements in refining processes and methods which came out of the stimulated wartime research program, some refineries are stepping up their technological divisions in the company's organizational setup. One company gives its technological service division the same position as an operating refinery, under the chief executive who heads refining operations. The head of this division makes his suggestions for mechanical changes or changes in operational procedure direct to the chief executive, in place of going through the engineering department, as was formerly the case.

New means are also being found to offset the shortage of professional workers. The use in refinery laboratories of more workers of the technician grade, including women, has already been given public attention. More recently the companies have begun to use more clerks in the process control departments, to do the figuring and prepare reports which the engineering department was formerly doing, thus leaving the professional men more time for work requiring their special training.

To make up for the lack of knowledge among workers in the plant mechanical departments of the improved methods which have been developed in the crafts the oil companies are arranging for training classes in state vocational schools. Here men in the welding department, for example, can take refresher courses which acquaint them with the advances made during the war in arc welding. Machinists can take courses which teach them how to machine plastics and other new materials now used in the refinery equipment they are called on to handle and how to use the new types of power tools.

The present period of the shortage of professional workers has produced a great opportunity for plant workers in general to prepare themselves for higher type jobs where their increased productivity will secure for them higher incomes based on the soundest possible economic basis. In some instances the local refinery unions, where they fully understand the opportunities for the men in the special training and upgrading courses, are cooperating in the plant programs. In other cases, however, the unions are shortsighted enough to discard everything for their own program only of more pay for the same job.

Management's job today involves not only improving the workers' skills but also educating the unions to the fact that increased ability means increased wages.




# to help solve your alkylation spent acid disposal problem

General Chemical's comprehensive background in the technology of sulfuric acid, *plus* the Company's long experience in handling the chemical requirements of the Petroleum Refining Industry, have proved invaluable when applied to solving spent acid disposal problems.

Such "know how" may be helpful to you, too! For information, inquire of the nearest General Chemical Sales and Technical Service Office. At your service will be the resourcefulness of America's pioneer with the Contact Process by which most of today's high strength acid is made.

## AND SPECIFY THESE GENERAL CHEMICAL PRODUCTS

**SULFURIC ACID**

Standard Grade:
66° Baume (93.19% $H_2SO_4$); 99% $H_2SO_4$

Other Grades:
Diamond, 66° Baume
Crystal (low in iron) 66° Baume

**OLEUM**

15, 20, and 65% free $SO_3$

• • •

**Alkylation:** Anhydrous Hydrofluoric Acid, Sulfuric Acid
**Polymerization:** Fluosulfonic Acid
**Oil Well Acidizing:** Muriatic Acid
**Detergents:** Sodium Metasilicate—Disodium Phosphate—Trisodium Phosphate—Tetrasodium Pyrophosphate
**Treating Agents:** Aluminum Chloride Solution—Aluminum Sulfate
**Mud Conditioning:** Sodium Silicate—Disodium Phosphate—Trisodium Phosphate—TSPP (Tetrasodium Pyrophosphate)
**Other Chemicals:** Aqua Ammonia—Nitric Acid—Potassium Nitrite

**BAKER & ADAMSON REAGENTS AND FINE CHEMICALS**

BASIC CHEMICALS

GENERAL CHEMICAL COMPANY

FOR AMERICAN INDUSTRY

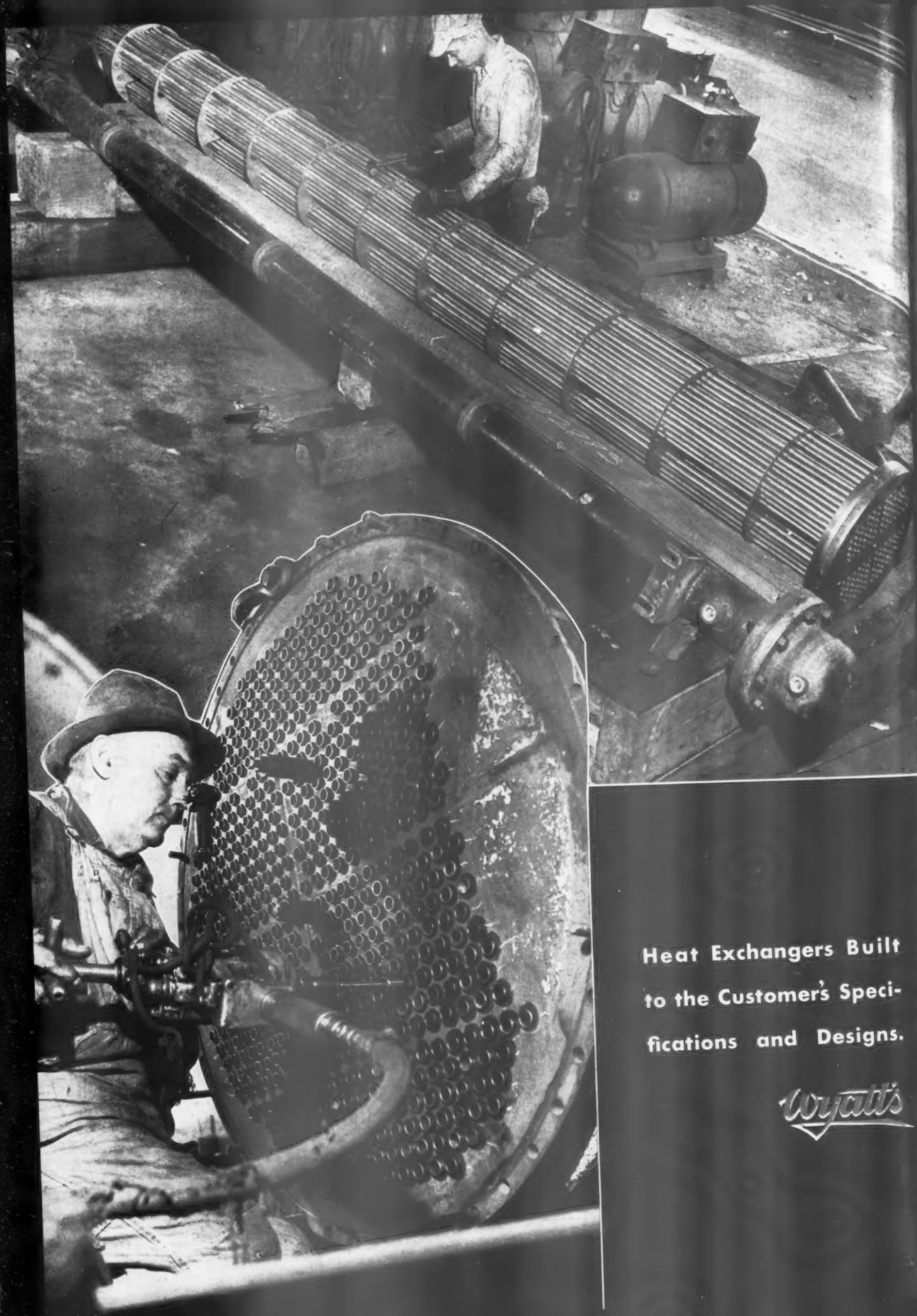
## GENERAL CHEMICAL COMPANY

40 RECTOR STREET, NEW YORK 6, N. Y.

*Sales and Technical Service Offices:* Atlanta • Baltimore • Boston • Bridgeport (Conn.) • Buffalo • Charlotte (N. C.) • Chicago • Cleveland • Denver • Detroit Houston • Kansas City • Los Angeles • Minneapolis • New York • Philadelphia Pittsburgh • Providence (R. I.) • San Francisco • Seattle • St. Louis • Utica (N. Y.) Wenatchee & Yakima (Wash.)

In Wisconsin: General Chemical Wisconsin Corporation, Milwaukee, Wis.

**In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver**



Heat Exchangers Built to the Customer's Specifications and Designs.

Wyatt's